



Trade skirmishes safeguards: A theory of the WTO dispute settlement process

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ARTICLE INFO

Article history:

Received 9 September 2007
Received in revised form 27 April 2010
Accepted 29 April 2010

JEL classification:

F13
F51
F53
K33

Keywords:

Dispute settlement
Safeguard Agreement
Impartial arbitration

ABSTRACT

I propose a framework within which to interpret and evaluate the major reforms introduced to the GATT system in its transition to the WTO. In particular, I examine the WTO Agreement on Safeguards that has amended the GATT escape clause (Article XIX), and the Dispute Settlement Body (DSB) that resembles a court of law under the WTO. Using this framework, I interpret the weakening of the reciprocity principle under the Agreement on Safeguards as an attempt to reduce efficiency-reducing trade skirmishes. The DSB is interpreted as an impartial arbitrator that announces its opinion about the state of the world when a dispute arises among member countries. I demonstrate that the reforms in the GATT escape clause should be bundled with the introduction of the DSB, in order to maintain the incentive compatibility of trade agreements. The model implies that trade agreements under the WTO lead to fewer trade skirmishes but this effect does not necessarily result in higher payoffs to the governments. The model also implies that the introduction of the WTO court, which has no enforcement power, can improve the self-enforceability of trade agreements.

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1. Introduction

Since its inception in 1995, the Dispute Settlement Body (DSB) of the WTO has played an important role in resolving disputes regarding the implementation of trade agreements. Countries with different levels of economic development and political power have shown a remarkably high respect for the rules and procedures of dispute settlement and to the rulings of the DSB. As of 2008, the DSB has ruled in 135 dispute cases with an overall compliance rate of more than 80%.¹

The economic literature is yet to provide a compelling explanation for the role of this institution in trade agreements. In particular, why did the members of the GATT, the predecessor of the WTO, decide to establish a quasi-legal institution, which cannot directly enforce its rulings, with a mandate to rule on the legitimacy of disputed trade policies?

In this paper I explore a role other than direct enforcement of trade agreements that the DSB can play to serve the interests of the trading partners. To explain this role I first need to discuss the contractual setting in which trade agreements are negotiated and implemented. I study trade agreements between governments who use trade policy instruments to achieve their political economic objectives. The point of departure is the assumption that political objectives of a given government are its private information and are subject to change over time. This implies that the first best agreement is one that is contingent on the state of the world. There is however a tension in implementing a contingent agreement when parties have asymmetric information about the state of the world as governments may disagree on the prevailing contingency.

Given the information asymmetry between the parties, a contingent, or flexible, trade agreement may be successfully implemented only if it constitutes a truthful mechanism. Both GATT and the WTO feature flexibility mechanisms that allow member countries to abandon their obligations under the agreement if some of their domestic industries are subject to substantial injury due to a surge in imports. The flexibility mechanism under GATT, which is often called the GATT escape clause, is based on a principle generally known as the reciprocity principle. Based on the reciprocity principle, if a government invokes the escape clause in response to a domestic political economic emergency, the affected parties are free to withdraw equivalent concessions immediately, so that an instantaneous balance of concession is maintained among parties at all time. Therefore, even though GATT was instrumental in

* I am grateful to Eric Bond, Andrew Daughety, Jennifer Reinganum, and Quan Wen for their guidance. I also thank Brett Benson, Mario Crucini, Scott Davis, Neda Ebrahimi, James Foster, Tommaso Tempesti, Ben Zissimos, and seminar participants at the 18th Annual Meetings of the Law and Economic Association for their helpful comments and discussions. I am also indebted to the editor, Bob Staiger, and an anonymous referee for comments that improved the paper substantially.

¹ See WTO (2009) for more information about cases considered by the DSB, and Wilson (2007) for a discussion about compliance with DSB rulings.

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0022-1996/\$ – see front matter © 2010 Elsevier B.V. All rights reserved.
doi:[10.1016/j.inteco.2010.04.008](https://doi.org/10.1016/j.inteco.2010.04.008)

ending the pre-GATT trade wars, in periods of high political pressure in one country, it prescribed a small-scale trade war, or “trade skirmish”, in order to keep the incentives of the negotiating parties in check. I show that the threat of a “trade skirmish” following the invocation of the escape clause is sufficient to prevent governments from using the escape clause opportunistically and, thus, the principle of reciprocity constitutes a truthful mechanism.

In contrast to the GATT escape clause, under the WTO Agreement on Safeguards a country can adopt a safeguard measure for a maximum period of four years without facing retaliation from affected countries unless the DSB rules against the adopted safeguard measure. Once again, the important question to ask is if and under what conditions the WTO Agreement on Safeguards constitutes a truthful mechanism. Moreover, even if the new flexibility mechanism is incentive compatible, what is the rationale to depart from the GATT reciprocity principle by conditioning the use of this principle on the ruling of a toothless court such as the DSB?

I model the DSB as an impartial arbitrator that investigates the state of the world and issues its opinion about the culpability of the safeguard-imposing country, that is, whether the situation in the defending country justifies a safeguard measure. The DSB’s observation of the state of the world is imperfect and, thus, its judgment may be wrong. In other words, the DSB is modeled as an imperfect public signalling device whose rulings are imperfectly correlated with the true state of the world. Private investigations by the disputing parties themselves cannot generate an informative public signal since the parties may act opportunistically in disclosing their findings. On the other hand the WTO arbitrators are presumably impartial entities who do not have the incentive to misrepresent their findings. Using this model of DSB, I show that the parties can negotiate an incentive-compatible agreement that limits retaliation against a safeguard-imposing country to cases where the DSB has dismissed the legitimacy of the safeguard measure.

I analyze the welfare effect of the transition from GATT to the WTO in terms of political welfare (defined as a weighted sum of consumer and producer surplus and government revenues, where a larger weight is given to the welfare of the organized political lobby groups) as well as social welfare (defined as an unweighted sum of all welfare components). I identify two channels through which the reform in the escape clause can improve the governments’ joint welfare. First, there are fewer trade skirmishes under the WTO, which is an efficiency gain by itself. Second, using a repeated-game framework, I show that the minimum patience (i.e., discount factor) needed to satisfy the self-enforcing constraint is lower under the WTO than under GATT. This analysis therefore suggests that, despite having no teeth, the dispute panels of the WTO can improve the enforceability of trade agreements.

As an extension to the main model, I formulate the decision making of a court that pursues the specific objective of maximizing the joint political welfare of the disputing governments. I characterize the optimal behavior of a “strategic” court and demonstrate that the member countries will benefit from a systematic bias towards protectionism if the court is sufficiently accurate. In contrast, a systematic bias towards free trade (i.e., a pro-complainant bias) is desired when the court is not sufficiently accurate.

This paper can be viewed in the tradition of the economic theory of contract remedies that was introduced to the study of international trade agreements by Sykes (1991). One tenet in this literature is that an enforcement system should encourage efficient breach, that is, the breach of a contract in situations where “the promisor is able to profit from his default after placing his promisee in as good a position as he would have occupied had performance been rendered” (Birmingham, 1969). A mechanism that is used by domestic courts to facilitate efficient breach is called the liability rule. Under this rule, a party to a contract is allowed to abandon its obligation if it compensates the breached-upon party for its loss from non-compliance. As Schwartz and Sykes (2002) explain, the reciprocity principle may be interpreted as a liability rule to encourage efficient breach of trade agreements,

since this principle is effectively a mechanism to hold the breaching country responsible for the injury that it imposes on other countries. However, as emphasized above, under the WTO a safeguard-imposing country is not necessarily liable for the damages it may cause. This paper suggests that the WTO has developed a new contract remedy scheme to minimize the rate of efficiency-reducing trade skirmishes.

A number of studies have explored the informational role of the WTO. Furusawa (2003) models the WTO as an entity that can observe “perfectly” the true state of the world in the defending country, while the complainant receives only a noisy signal about it. Reinhardt (2001) and Rosendorf (2005) study the safeguard clause assuming that a dispute panel rules against the defendant with a fixed and publicly known probability that is not correlated with the true state of the world. Finally, in Maggi (1999), the role of the WTO is to disseminate information on deviations in order to facilitate “multilateral” punishments.

Riezman (1991) interprets the volume of trade to a country as a public signal of hidden protectionist policies of its government and shows that governments can sustain a cooperative outcome (i.e., low tariffs) with occasional periods of high tariff when a country’s import volume falls substantially. In a similar framework, Park (2008) analyzes the issue of enforcing international trade agreements when the less-informed parties may receive a private signal of the state of the world.

In taking a mechanism design approach to study trade agreements, my model is similar to Feenstra and Lewis (1991), Bagwell and Staiger (2005), Martin and Vergote (2008), and Beshkar (2010). None of these papers, however, provides a model of the DSB and its role in trade agreements. Finally, Ludema (2001) models the DSB as an institution that eases communication after an agreement has begun and reaches the negative result that improved communication and the opportunity to renegotiate an agreement hinders cooperation by diluting the threat of severe punishment for breach of the agreement. In a similar context, Klimenko et al. (2007) model the DSB as an institution that prevents governments from ignoring past violations in order to keep the punishment threats credible.

In the next section, I provide a justification for using a political economy framework. The basic setup is presented in Section 3. Sections 4 and 5 introduce the models of the GATT and WTO. Sections 6 and 7 compare the performance of the two institutions from political and social welfare points of view. Section 8 addresses the issue of enforcement in a repeated-game framework. The optimal decision making by the DSB is analyzed in Section 9.

2. Contractual environment

In this paper I adopt a political economy framework to study the safeguard clause under the GATT and the WTO. In particular, I follow Hillman (1982), Sykes (1991, 2006), and Baldwin and Robert-Nicoud (2007), in viewing safeguards as a response by governments to the political pressure from domestic interest groups. Hillman (1982) and Baldwin and Robert-Nicoud (2007) argue that declining industries experience a greater return to investment in lobbying for protection because rents from protection will not be dissipated by new entry. On the other hand, Sykes (1991, 2006) points out that the declining industries are more likely to meet the two main conditions for a safeguard measure, i.e., a surge in imports and substantial injury. Therefore, one can argue that the main motivation behind the safeguard clause is to allow governments to dissipate political pressures from declining industries for increased protection.

This view is in line with Dam’s (1970) argument that “the presence of [the safeguard clause] encourages cautious countries to enter into a greater number of tariff bindings than would otherwise be the case.” In other words, a rigid agreement that does not allow governments to suspend their obligations under high political pressure, makes the governments reluctant to give generous concessions in the first place.

In principle, a safeguard-imposing country could offer cash transfer or concessions on other products in order to avoid retaliation. However,

a cash transfer is rarely used to compensate other countries for breach of trade agreements.² Moreover, safeguard-imposing countries may find it very difficult to grant alternative concessions as a way of avoiding punishment. As Jackson (1997, p. 194) points out,

"as the general average of tariffs has declined to a very low point, ... it has become increasingly harder for countries invoking safeguard measures to be able to effectively compensate affected countries by way of granting alternative concessions. Usually the "compensation bill" is sufficiently large that it becomes extremely difficult to find any products that have a tariff high enough to make an alternative concession meaningful, except for products that are already very sensitive and subject to the pressures of the domestic interests who claim they are already harmed by imports."

In the GATT era, as a result, governments usually turned away from the safeguard measures and negotiated extra-legal forms of trade barrier, such as Voluntary Export Restraints (VERs), which allowed the affected countries to share the rents generated by higher protection. Some scholars have interpreted the loosening of the safeguard discipline as an attempt to divert protectionist policies from relying heavily on 'gray-area' and discriminatory measures, such as VERs and antidumping policies, towards safeguard measures. On the efficiency grounds, economists typically prefer that a country resort to safeguard measures, which are applied nondiscriminarily, in lieu of antidumping measures that discriminate among foreign exporters (Bown, 2002). Moreover, the use of VERs is criticized as lacking transparency and enabling international cartels with the help of governments (Rosendorff, 1996).³ In fact, the Agreement on Safeguards "was negotiated in large part because GATT Contracting Parties increasingly had been applying a variety of so-called 'gray-area' measures."⁴ In other words, elimination of the compensatory requirement was intended to make the safeguard measures a more appealing instrument of protection to the governments. As a consequence of the reforms in the safeguard clause, the relative use of safeguard measures has been on the rise since the establishment of the WTO in 1995 (Fig. 1).

3. The model

3.1. Basic setup

Consider a pair of distinct goods x and y with demand functions in the home country (no *) and the foreign country (*) given by:

$$\begin{aligned} D_x(p_x) &= 1 - p_x, \quad D_y(p_y) = 1 - p_y, \\ D_x^*(p_x^*) &= 1 - p_x^*, \quad D_y^*(p_y^*) = 1 - p_y^*, \end{aligned} \quad (1)$$

where p (with the appropriate index) represents the price of a good in a certain country. Specific import tariffs, τ and τ^* , chosen by countries as the only trade policy instrument, create a gap between domestic and foreign prices. In particular, $p_x = p_x^* + \tau$ and $p_y = p_y^* - \tau^*$.

² See Limão and Saggi (2008) for a potential explanation of why governments do not use cash as a compensation method.

³ For example, in the case of Japan's voluntary restriction on steel exports to the United States, the Consumers' Union of the United States filed a lawsuit against the US government and Japanese and US steel makers, claiming that there was a conspiracy to divide the US and Japanese markets that violated the Sherman Act (Matsushita et al., 2003, p. 215).

⁴ Quoted by Sykes (2006, p. 26) from a report on the WTO website.

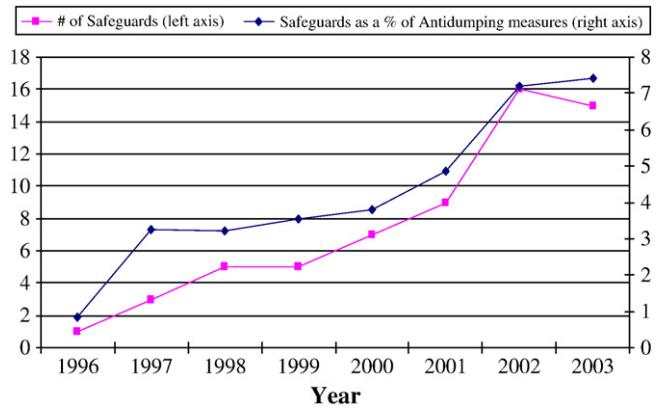


Fig. 1. The use of the safeguard measure over time.
Source: The World Bank and the WTO.

Both countries produce both goods using the following supply functions:

$$\begin{aligned} Q_x(p_x) &= p_x, \quad Q_y(p_y) = bp_y, \\ Q_x^*(p_x^*) &= bp_x^*, \quad Q_y^*(p_y^*) = p_y^*. \end{aligned} \quad (2)$$

Assuming $b > 1$, the home country will be a natural importer of x and a natural exporter of y .

For reasons that will be clear later, I assume that there is another pair of goods which countries produce and consume in an identical manner as above. Finally, there is a numeraire good, z , which is abundant in each country and is used either as a consumption good or as an input to the production of other goods.

Under this model, the market-clearing price of x (y) depends only on the home (foreign) tariff. Let $p_x(\tau)$ and $p_y(\tau^*)$ respectively denote the equilibrium prices of x and y in the home country. If import tariffs are non-prohibitive (i.e., if they are sufficiently small) trade occurs between the countries and the home consumers' surplus from the consumption of x and y will be given by $\psi_x(\tau) \equiv \int_{p_x(\tau)}^1 D_x(u) du$, and $\psi_y(\tau^*) \equiv \int_{p_y(\tau^*)}^1 D_y(u) du$, respectively. Moreover, the home producers' surplus from the sale of x and y will be given by $\pi_x(\tau) \equiv \int_0^{p_x(\tau)} Q_x(u) du$, and $\pi_y(\tau^*) \equiv \int_0^{p_y(\tau^*)} Q_y(u) du$, respectively. Finally, the government's tariff revenue is given by $T(\tau) \equiv \tau M_x(p_x(\tau))$, where $M_x(p_x) \equiv D_x(p_x) - Q_x(p_x)$, is the import demand for good x in the home country.

3.2. A political objective function

Following Baldwin (1987), I assume that each government maximizes a weighted sum of its producers' surplus, consumers' surplus, and tariff revenues with a relatively higher weight on the surplus of a import-competing sector. The higher weight given to the welfare of a sector might be the result of political pressure, through lobbying for example, that a government faces. Denoting the political weight on the welfare of the import-competing sector in the home (foreign) country by θ (θ^*), where $\theta, \theta^* \geq 1$, I assume that the home government's welfare drawn from sector x as a function of the home import tariff is given by $u(\tau; \theta) \equiv \psi_x(\tau) + \theta \pi_x(\tau) + T(\tau)$, and the home government's welfare from sector y as a function of the foreign import tariff is given by $v(\tau^*) \equiv \psi_y(\tau^*) + \pi_y(\tau^*)$. Therefore, $u(\tau; \theta) + v(\tau^*)$ represents the political welfare of the home government, which is additively separable in functions of the home and foreign tariffs.

Lemma 1. $u(\tau; \theta)$ is a concave function of τ and is increasing for sufficiently small τ . In contrast, $v(\tau^*)$ is a convex function and is decreasing for sufficiently small τ^* .

This lemma implies that the home government's welfare is increasing in the home tariff and decreasing in the foreign tariff when these tariffs are sufficiently low.

If the home government were to set its policies unilaterally, it would choose τ to maximize $u(\tau; \theta) + v(\tau^*)$. This is tantamount to choosing a tariff rate that maximizes the home government's welfare from its import-competing sector, $u(\tau; \theta)$. Therefore, the non-cooperative (Nash) tariff as a function of political pressure is given by

$$\tau^N(\theta) \equiv \arg \max_{\tau} u(\tau; \theta). \quad (3)$$

In setting its policy unilaterally, the home government ignores the impact of its tariff on the welfare of the foreign government which is captured by $v(\tau)$. Had governments managed to set tariffs cooperatively, the politically efficient home tariff, τ^{PE} , should maximize $u(\tau; \theta) + v(\tau)$, which is the joint payoff of the home and foreign governments from an import tariff at home.⁵ Namely,

$$\tau^{PE}(\theta) = \arg \max_{\tau} u(\tau; \theta) + v(\tau). \quad (4)$$

Lemma 2. $\tau^{PE}(\theta)$ and $\tau^N(\theta)$ are increasing in θ and $\tau^{PE}(\theta) < \tau^N(\theta)$.

In the above analysis, I relied on the assumption that any tariffs that governments may rationally choose are non-prohibitive. Since setting a tariff higher than $\tau^N(\theta)$ is not individually rational, this assumption is satisfied if $\tau^N(\theta)$ is not prohibitive. The following assumption ensures that no prohibitive tariff will be chosen by any government:

Assumption 1. $\theta < \frac{2}{5} \frac{4b+1}{b+1}$. \square

3.3. Private political pressures, monitoring, and contingent agreements

I assume that political pressures can take two levels, i.e., low and high, denoted respectively by $\underline{\theta}$ and $\bar{\theta}$. Remember that each country has two import-competing industries which may exert political pressure in order to restrict imports of the like products. I assume that these pressures are realized according to the following probability distribution:

$$\begin{aligned} \Pr(\text{high pressure from both industries}) &= 0, \\ \Pr(\text{high pressure from only one industry}) &= \rho, \\ \Pr(\text{no high pressure}) &= 1-\rho, \end{aligned}$$

where, $0 < \rho < 1$. This probability distribution ensures that in each country there is at least one import-competing industry which exerts low political pressure. The availability of such an industry will make the analysis of the retaliation provisions in trade agreements much simpler. I also maintain the following assumption throughout the paper.

Assumption 2. $\underline{\theta}$ and $\bar{\theta}$ are such that $\tau^{PE}(\bar{\theta}) < \tau^N(\underline{\theta})$. \square

This assumption ensures that if an agreement sets a tariff binding equal to or smaller than $\tau^{PE}(\bar{\theta})$, the governments will always choose the highest tariff authorized under the agreement.

I assume that the realization of θ (θ^*) is private information of the home (foreign) government. Therefore, the agreement cannot be contingent on political pressures unless the governments have the proper incentives to reveal their private information truthfully. Using the revelation principle, one might be able to design a mechanism that induces governments to reveal truthfully the political pressure that

⁵ Bagwell and Staiger (1999, 2002) first introduced this definition of politically efficient (or, in their language, politically optimal) tariffs.

⁶ It is shown in Appendix A that the Nash tariff will be non-prohibitive if and only if $\theta < \frac{3b-1}{b+1}$. However, I need to make the stronger assumption that $\theta < \frac{2}{5} \frac{4b+1}{b+1}$ in order for the other results of the paper to hold.

they face at home. In particular, an agreement can be designed contingent upon the countries' announcements regarding their respective political pressure. In this paper, however, I am interested in analyzing the best agreements that can be written under two alternative institutional settings, namely, GATT and the WTO. Therefore, I will take the rules under these institutions as given and solve for the best incentive-compatible agreement under each institution.

Even though domestic political pressures are private information of the government, outsiders (e.g., other governments and WTO arbitrators) can obtain a noisy signal about it by investigating the state of the world in the country. If the signal that outsiders receive is publicly observable and sufficiently informative, then a contract contingent upon the signal could provide some efficiency improvement over a non-contingent contract that ignores the signal. However, political pressure is a subjective concept that is hard to quantify using a verifiable measure. In fact, different parties may reach different conclusions (i.e., observe different signals) regarding the true state of the world, while their conclusions are their respective private information. While the negotiating parties would act strategically in revealing their private information, an impartial third-party, by definition, has no incentive to distort the truth. Thus, an impartial arbitrator will be able to provide a public signal that can be used, along with the parties' announcements, to write a contingent agreement.

The sequence of events is as follows. After adopting a regime (i.e., GATT or WTO), the governments negotiate a two-step tariff schedule (l, s) , where $l < s$. The governments are supposed to adopt the negotiated low tariff, l , for their low-pressure industries, and to use the negotiated safeguard tariff, s , for their high-pressure industries. Each country privately observes its domestic state of the world and makes a public announcement about it, denoted by $\hat{\theta}$ and $\hat{\theta}^*$ where $\hat{\theta}, \hat{\theta}^* \in \{\underline{\theta}, \bar{\theta}\}$. By announcing high political pressure, a government claims that one (and only one) of its import-competing industries is exerting high pressure. Announcing low pressure, on the other hand, implies that no import-competing industry is exerting high pressure. As will be seen in detail, GATT and the WTO differ in the way they regulate further steps. The tariff agreement under GATT is contingent on the reports of the governments about their respective state of the world. However, under the WTO, the tariff agreement is contingent on the combination of the governments' and the WTO's reports about the state of the world.

4. Trade agreements under GATT: no public monitoring

According to the GATT safeguard clause (Article XIX), if any product is being imported into the territory of a negotiating party in such increased quantities and under such conditions as to cause or threaten serious injury to domestic producers in that territory, the negotiating party will be free to suspend its obligation by putting in place protectionist measures to help its endangered industry. In response, the affected exporting countries will be free to withdraw some of their previously-granted concessions in a way that is substantially equivalent to concessions withdrawn by the safeguard-imposing country. In other words, the GATT safeguard clause requires the negotiating parties to maintain a balance of concessions at each point in time.

I model the GATT safeguard clause as follows. If both governments announce low political pressures they should choose l for all of their imports. If the home government announces high political pressure, i.e., $\hat{\theta} = \bar{\theta}$, it will impose the negotiated safeguard tariff, s , on the import of the good that according to the home government has resulted in high political pressure. In response to the announcement $\hat{\theta} = \bar{\theta}$, the foreign government will also impose s on the imports of a good that is in competition with a low-pressure industry. Other combinations can be obtained due to symmetry. Table 1 summarizes the strategy profile, referred to as the GATT strategy profile, to be

Table 1
GATT strategy profile.

		Foreign	
		$\bar{\theta}$	$\underline{\theta}$
Home	$\bar{\theta}$	{s, s}, {s, s}	{s, l}, {s, l}
	$\underline{\theta}$	{s, l}, {s, l}	{l, l}, {l, l}

employed by the governments. In this table the set of tariffs to be chosen by each government for each combination of announcements is given.

If both countries announce their state of the world truthfully, the expected per-period payoff to the home government is given by:

$$\begin{aligned} & \rho^2 \{[u(s; \bar{\theta}) + u(s; \bar{\theta})] + [v(s) + v(s)]\} \quad (\theta = \theta^* = \bar{\theta}) \\ & + (1-\rho)^2 \{[u(l; \bar{\theta}) + u(l; \underline{\theta})] + [v(l) + v(l)]\} \quad (\theta = \theta^* = \underline{\theta}) \\ & + (1-\rho)\rho \{[u(s; \bar{\theta}) + u(l; \underline{\theta})] + [v(s) + v(l)]\} \quad (\theta = \bar{\theta}, \theta^* = \underline{\theta}) \\ & + (1-\rho)\rho \{[u(s; \underline{\theta}) + u(l; \underline{\theta})] + [v(s) + v(l)]\} \quad (\theta = \underline{\theta}, \theta^* = \bar{\theta}) \end{aligned}$$

The expression on the first line above represents the welfare of the home government (weighted by ρ^2) when both countries are experiencing high political pressure, where ρ^2 is the probability of this contingency. Under this contingency, both countries impose s on all of their imports. As a result, the home government receives $u(s; \bar{\theta}) + u(s; \underline{\theta})$ from its importing sectors and $v(s) + v(s)$ from its exporting sectors. Welfare under other contingencies can be calculated similarly. Simplifying the above expression gives the expected per-period welfare of a country under GATT as a function of the negotiated tariffs, l and s :

$$P^G(l, s) = \rho[u(s; \bar{\theta}) + v(s) + u(s; \underline{\theta}) + v(s)] + 2(1-\rho)[u(l; \underline{\theta}) + v(l)]. \quad (5)$$

$P^G(l, s)$ can be also interpreted as the expected joint welfare of the home and foreign governments as a function of the home tariffs.

The best incentive-compatible negotiated agreement under the GATT rules will be one that maximizes $P^G(l, s)$ subject to some incentive constraints that ensure truthful revelation of private information by the negotiating parties. To construct the incentive compatibility constraints, note that when a government is faced with low pressure, its expected payoff from claiming low pressure is $u(l; \underline{\theta}) + v(l) + (1-\rho)[u(l; \underline{\theta}) + v(l)] + \rho[u(s; \underline{\theta}) + v(s)]$, while its expected payoff from lying is $u(s; \underline{\theta}) + v(s) + (1-\rho)[u(l; \underline{\theta}) + v(l)] + \rho[u(s; \underline{\theta}) + v(s)]$. Therefore, truth-telling requires

$$u(l; \underline{\theta}) + v(l) \geq u(s; \underline{\theta}) + v(s). \quad (6)$$

Similarly, truthful revelation of high pressure is ensured if

$$u(s; \bar{\theta}) + v(s) \geq u(l; \bar{\theta}) + v(l). \quad (7)$$

In short, the negotiators' problem under GATT can be summarized as

$$\max_{l, s} P^G(l, s) \quad (8)$$

subject to incentive constraints (6) and (7).

Ignoring the incentive constraints, the solution to the unconstrained maximization of $P^G(l, s)$ can be written as

$$l^G = \arg \max_l [u(l; \underline{\theta}) + v(l)] \equiv \tau^{PE}(\underline{\theta}), \quad (9)$$

$$s^G = \arg \max_s [u(s; \bar{\theta}) + v(s) + u(s; \underline{\theta}) + v(s)]. \quad (10)$$

Also, it is straightforward to show that $\tau^{PE}(\underline{\theta}) < s^G < \tau^{PE}(\bar{\theta})$. Thus,

$$\tau^{PE}(\underline{\theta}) = l^G < s^G < \tau^{PE}(\bar{\theta}). \quad (11)$$

But Eq. (11) is also a sufficient condition for Eqs. (6) and (7) to be satisfied. To see this, recall that according to Lemma 1, $u(\tau; \theta) + v(\tau)$ is concave and attains its maximum at $\tau = \tau^{PE}(\theta)$. This implies that Eqs. (6) and (7) are satisfied as long as $\tau^{PE}(\underline{\theta}) \leq l \leq s \leq \tau^{PE}(\bar{\theta})$. Formally,

Proposition 1. *The incentive compatibility constraints are not binding in the GATT negotiators' problem (8), and the best incentive-compatible negotiated tariff schedule under GATT is given by (l^G, s^G) . Moreover, $\tau^{PE}(\underline{\theta}) = l^G < s^G < \tau^{PE}(\bar{\theta})$.*

The fact that these incentive constraints are not binding suggests that the GATT's instantaneous reciprocity principle imposes more punishment than necessary to keep the governments truthful in disclosing their private information.

5. Trade agreement under WTO: public monitoring provided by DSB

In contrast to the GATT Article XIX, the Safeguard Agreement of the WTO does not require a safeguard-imposing country to compensate the affected exporting countries if the surge in imports has caused or threatened serious injury to the domestic industries. If a dispute arises among the parties on whether some prevailing situations legitimize the use of safeguards by one country, a *panel of experts* appointed by the WTO would issue its opinion on the prevailing state of the world. I take the view that the parties regard the panel's opinion as a public signal which is correlated with the true state of the world in the defending country. Letting $\hat{\theta} \in \{\underline{\theta}, \bar{\theta}\}$ ($\hat{\theta}^* \in \{\underline{\theta}, \bar{\theta}\}$) denote the panel's opinion about the state of the world in the home (foreign) country, I assume that the panel can recognize the true state of the world in either country with probability $\gamma \in (0, 1)$, i.e., $\Pr(\hat{\theta} = \underline{\theta} | \theta = \underline{\theta}) = \Pr(\hat{\theta} = \bar{\theta} | \theta = \bar{\theta}) = \gamma$.

If the home country announces high political pressure, i.e., $\hat{\theta} = \bar{\theta}$, which also indicates its intention to implement a safeguard measure on one of its imports, it should defend its case before the dispute panel. The dispute panel investigates the truthfulness of the announcement and issues its opinion about the state of the world in the home (i.e., defending) country. If the panel upholds the defendant's claim, that is, if $\hat{\theta} = \theta = \bar{\theta}$, then the complaining country is not authorized to retaliate against the defending country. However, if the panel dismisses the defendant's claim, the complaining country can retaliate against the defending country by adopting a safeguard-level tariff, s , on one of its imports that is not currently eligible for a safeguard.⁷

5.1. Payoffs under WTO

In this subsection I calculate the expected payoffs of the home government (which is equal to that of the foreign government due to symmetry), given that both countries follow the strategy profile laid

⁷ The availability of such an importing industry in the complaining country is ensured by the assumption that in a given period, protectionist pressures may be present in at most one of the two importing sectors.

out above. First consider the case where both countries face low political pressures, which happens with a probability of $(1-\rho)^2$. In this situations both countries set the negotiated low tariff, l , on all imports, and the home government obtains $2[u(l; \underline{\theta}) + v(l)]$.

With probability $\rho(1-\rho)$ we have $\theta=\underline{\theta}$, and $\theta^*=\bar{\theta}$. The panel will approve the foreign country's decision to implement safeguards with probability γ , in which case the home country should choose low tariffs on all imports. With probability $1-\gamma$, the panel will disapprove the foreign government's decision, in which case the home government will be authorized to retaliate by choosing s on one import. Therefore, the expected payoff to the home government (before the panel's decision is announced) is given by $[\gamma u(l; \underline{\theta}) + (1-\gamma)u(s; \underline{\theta}) + v(s)] + [u(l; \underline{\theta}) + v(l)]$.

Similarly, the case where $\theta=\bar{\theta}$ and $\theta^*=\underline{\theta}$ can happen with probability $\rho(1-\rho)$, and the payoff to the home government will be $[u(s; \bar{\theta}) + \gamma v(l) + (1-\gamma)v(s)] + [u(l; \underline{\theta}) + v(l)]$. When both countries receive high pressure, which happens with probability ρ^2 , the payoff to the home government is:

$$\begin{aligned} &\gamma^2 \{ [u(s; \bar{\theta}) + v(s)] + [u(l; \underline{\theta}) + v(l)] \} \\ &+ (1-\gamma)^2 \{ [u(s; \bar{\theta}) + v(s)] + [u(s; \underline{\theta}) + v(s)] \} \\ &+ \gamma(1-\gamma) \{ [u(s; \bar{\theta}) + v(s)] + [u(s; \underline{\theta}) + v(l)] \} \\ &+ \gamma(1-\gamma) \{ [u(s; \bar{\theta}) + v(s)] + [u(l; \underline{\theta}) + v(s)] \}. \end{aligned}$$

The expression on the first line above reflects the case where the panel makes a correct judgment on both countries' claims. The second line is for the case where the panel's judgments are both wrong. The third line represents the case where the panel approves the home government's claim but not that of the foreign government. The last line represents the case where the panel approves the foreign government's claim but not that of the home government. Taking the expectation of these contingent payoffs (with respect to θ and θ^*) and simplifying yields the ex ante expected payoff of the home government (before the realization of political pressures) as follows:

$$\begin{aligned} P^W(l, s) = &\rho[u(s; \bar{\theta}) + v(s)] + \rho(1-\gamma)[u(s; \underline{\theta}) + v(s)] \\ &+ (2(1-\rho) + \rho\gamma)[u(l; \underline{\theta}) + v(l)]. \end{aligned} \quad (12)$$

Lemma 3. Denoting the solution to the unconstrained maximization of $P^W(l, s)$ by l^{Wu} and s^{Wu} , we have $l^{Wu} = \tau^{PE}(\underline{\theta}) < s^{Wu} \leq \tau^{PE}(\bar{\theta})$. Moreover, s^{Wu} is an increasing function of γ , which is equal to s^G when $\gamma=0$ and is equal to $\tau^{PE}(\bar{\theta})$ when $\gamma=1$.

5.2. Incentive constraints

In this subsection I lay out the home government's incentive constraints assuming that the foreign government tells the truth. Due to symmetry, the foreign government's incentive constraints will be identical to those of the home government.

When $\theta=\underline{\theta}$, the home government's payoff from lying is $[u(s; \underline{\theta}) + \gamma v(s) + (1-\gamma)v(l)]$. That is because by claiming a high shock, when it is actually low, the government receives $u(s; \underline{\theta})$ from its protected sector, while it will face retaliation against one of its exporting sectors with probability γ , resulting in an expected payoff of $\gamma v(s) + (1-\gamma)v(l)$ from the exporting sector. By telling the truth, on the other hand, the government will receive $[u(l; \underline{\theta}) + v(l)]$. Therefore, the incentive constraint under this contingency is $u(s; \underline{\theta}) + \gamma v(s) + (1-\gamma)v(l) \leq u(l; \underline{\theta}) + v(l)$, or, equivalently

$$u(s; \underline{\theta}) + \gamma v(s) \leq u(l; \underline{\theta}) + \gamma v(l). \quad (13)$$

When $\theta=\bar{\theta}$, the government's expected payoff from invoking a safeguard measure (i.e., claiming high pressure) is $u(s; \bar{\theta}) + \gamma v(l) + (1-\gamma)v(s)$, and its payoff without invoking a safeguard measure is $u(l; \bar{\theta}) + v(l)$. Therefore, the incentive constraint when $\theta=\bar{\theta}$ is given by $u(s; \bar{\theta}) + \gamma v(l) + (1-\gamma)v(s) \geq u(l; \bar{\theta}) + v(l)$, or, equivalently, by

$$u(s; \bar{\theta}) + (1-\gamma)v(s) \geq u(l; \bar{\theta}) + (1-\gamma)v(l). \quad (14)$$

In short, the negotiators' problem under the WTO can be summarized as

$$\max_{l, s} P^W(l, s) \quad (15)$$

subject to incentive constraints (13) and (14).

The following lemma will be useful in analyzing these incentive constraints.

Lemma 4. Assuming that $0 \leq \alpha \leq 1$, $u(\tau; \theta) + \alpha v(\tau)$ is a concave function of τ and is symmetric around $\tau=m(\theta, \alpha)$, where

$$m(\theta, \alpha) \equiv \arg \max_{\tau} [u(\tau; \theta) + \alpha v(\tau)].$$

Moreover, $m(\theta; \alpha)$ is increasing in θ and decreasing in α .

The concave function $u(\tau; \theta) + \alpha v(\tau)$, is the general functional form of the expressions on each side of the incentive constraints, such that in the incentive constraint (13) we have $\alpha=\gamma$ and $\theta=\underline{\theta}$, and in the incentive constraint (14) we have $\alpha=1-\gamma$ and $\theta=\bar{\theta}$. Also the function $m(\theta, \alpha)$ given in this lemma can be used to rewrite the politically efficient tariffs as $\tau^{PE}(\underline{\theta})=m(\underline{\theta}, 1)$ and $\tau^{PE}(\bar{\theta})=m(\bar{\theta}, 1)$.

It is now straightforward to show that the unconstrained optimal negotiated tariffs, l^{Wu} and s^{Wu} , satisfy Eq. (14) and thus Eq. (14) is not a binding incentive constraint. To see this, note that since $m(\theta, \alpha)$ is increasing in θ and decreasing in α , we have $m(\underline{\theta}, 1) < m(\bar{\theta}, 1) < m(\bar{\theta}, 1-\gamma)$, or, equivalently $\tau^{PE}(\underline{\theta}) < \tau^{PE}(\bar{\theta}) < m(\bar{\theta}, 1-\gamma)$. Now recall from Lemma 3 that $l^{Wu} = \tau^{PE}(\underline{\theta}) < s^{Wu} \leq \tau^{PE}(\bar{\theta})$, and rewrite the above inequalities as $l^{Wu} < s^{Wu} < m(\bar{\theta}, 1-\gamma)$. But since $u(\tau, \bar{\theta}) + (1-\gamma)v(\tau)$ is a concave function that attains its maximum at $m(\bar{\theta}, 1-\gamma)$ this inequality implies that:

$$u(l^{Wu}; \bar{\theta}) + (1-\gamma)v(l^{Wu}) < u(s^{Wu}; \bar{\theta}) + (1-\gamma)v(s^{Wu}).$$

Therefore, the incentive constraint (14) is not binding.

Now consider the incentive constraint (13). Since $l^{Wu} < s^{Wu}$ for all $\gamma \in [\frac{1}{2}, 1]$, and $u(\tau; \theta) + \gamma v(\tau)$ is concave and symmetric around $m(\theta, \gamma)$, the incentive constraint (13) is non-binding if and only if $s^{Wu} + l^{Wu} \geq 2m(\theta, \gamma)$. Fig. 2 depicts a situation where this inequality, and hence, the incentive constraint (13), is satisfied. This inequality is violated for $\gamma = \frac{1}{2}$ (because $l^{Wu} < s^{Wu} (\gamma = \frac{1}{2}) < m(\underline{\theta}, \frac{1}{2})$)⁸ and is satisfied if $\gamma = 1$ (because $l^{Wu} = m(\underline{\theta}, 1) < s^{Wu} (\gamma = 1) = m(\bar{\theta}, 1)$). Moreover, $s^{Wu} + l^{Wu}$ is increasing in γ (Lemma 3) while $2m(\theta, \gamma)$ is decreasing in γ (Lemma 4). Therefore,

Lemma 5. There exists $\gamma_2 \in (\frac{1}{2}, 1)$ such that l^{Wu} and s^{Wu} are incentive compatible and thus optimal solutions to the WTO negotiators' problem (15) if and only if $\gamma \geq \gamma_2$.

In other words, if the dispute panel's judgment is sufficiently accurate, i.e., if $\gamma > \gamma_2$, the incentive constraints are not binding. However, if $\gamma < \gamma_2$, we have $s^{Wu} < 2m(\theta, \gamma) - l^{Wu}$ and the incentive constraint (13) is binding.

⁸ For $\gamma = \frac{1}{2}$ we have $s^{Wu} = 2 \frac{\theta-1}{b(4-\theta)+10-\theta}$ and $m(\underline{\theta}, \frac{1}{2}) = \frac{1}{2} \frac{b-1}{(b+1)(b+4)}$. The sufficient condition for $s^{Wu} (\gamma = \frac{1}{2}) < m(\underline{\theta}, \frac{1}{2})$ is therefore $\bar{\theta} < \frac{4b+1}{5(b+1)}$, which is guaranteed by Assumption 1 (calculations are provided in Appendix A under the Proof of Lemma 6).

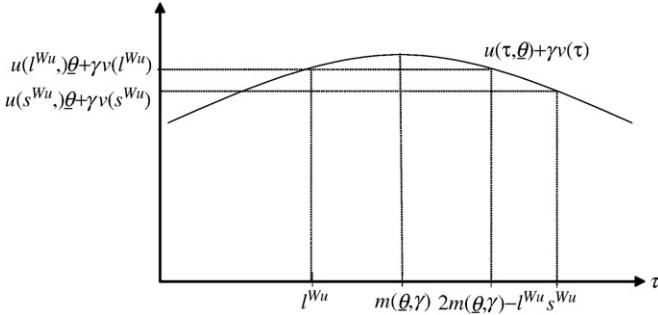


Fig. 2. An example where the incentive constraint (13) is satisfied, i.e., when $s^Wu \geq 2m(\underline{\theta}; \gamma) - l^Wu$.

The following lemma characterizes the optimal negotiated tariffs under the WTO when this incentive constraint is binding.

Lemma 6. There exists $\gamma_1 \in (\frac{1}{2}, \gamma_2)$ such that the optimal solution to the WTO negotiators' problem (15) satisfies $l + s = 2m(\underline{\theta}, \gamma)$ if $\gamma_1 \leq \gamma \leq \gamma_2$, and satisfies $l = s$ if $\gamma \leq \gamma_1$.

Therefore, for very low qualities of judgment, i.e., when $\gamma \leq \gamma_1$, the optimal solution to Eq. (15) is a non-contingent tariff schedule, denoted by τ^{nc} . Letting (l^{Wr}, s^{Wr}) denote the optimal solution to Eq. (15) when $\gamma_1 < \gamma < \gamma_2$, the best incentive-compatible tariff schedule under the WTO for different levels of γ can be summarized by (l^W, s^W) , where

$$l^W \equiv \begin{cases} l^{Wu} & \text{if } \gamma \geq \gamma_2 \\ l^{Wr} & \text{if } \gamma_1 < \gamma < \gamma_2 \\ \tau^{nc} & \text{if } \gamma \leq \gamma_1 \end{cases} \quad \text{and} \quad s^W \equiv \begin{cases} s^{Wu} & \text{if } \gamma \geq \gamma_2 \\ s^{Wr} & \text{if } \gamma_1 < \gamma < \gamma_2 \\ \tau^{nc} & \text{if } \gamma \leq \gamma_1. \end{cases}$$

In Appendix A, it is shown that these tariffs can be ranked as follows:

Lemma 7. $l^{Wu} < l^{Wr} < \tau^N(\underline{\theta})$ and $s^{Wu} < s^{Wr} < \tau^N(\bar{\theta})$.

That is, a binding incentive compatibility constraint results in higher agreement tariffs, namely, $l^{Wr} > l^{Wu}$ and $s^{Wr} > s^{Wu}$. In either case, the low and safeguard tariffs under the WTO are less than the non-cooperative (Nash) tariffs.

6. Political welfare under WTO vs. GATT

A potential source of political welfare improvement in transition from GATT to the WTO is the reduced rate of trade skirmishes under the WTO. The frequency of trade skirmishes under the WTO, $2\rho(1-\gamma)$, is less than its frequency under GATT, 2ρ . The reduced rate of retaliations under the WTO can benefit the negotiating parties in two ways. First, since retaliatory tariffs are less efficient than normal tariffs, all else equal, fewer invocations of retaliatory provisions will improve the welfare of the governments. In other words, restrictions on the use of the retaliation provision under the WTO reduce the pain to the governments from protecting their industries in periods of high political pressures. Second, note that in setting safeguard tariff rates, negotiators should take into account the inefficiency created by retaliations against the safeguard-imposing country. In fact, the prospect of inefficient retaliations may lead the negotiators to choose a safeguard tariff rate below the politically efficient tariff in periods of intense political pressures.⁹ Therefore, the second channel through

which governments may benefit from the reduced rate of retaliation is that they can agree on a politically more efficient, i.e., higher, tariff rate for periods of intense political pressures.

A drawback of the WTO Safeguard Agreement, however, is that the condition for truthful revelation of private information is binding for low qualities of DSB judgment in which case negotiators have to choose a less efficient tariff schedule (l, s) to ensure incentive compatibility of the agreement. In what follows, I show that for low levels of judgment quality, the costs to the governments of switching to the WTO Safeguard Agreement outweigh its benefits. Therefore, a high-quality Dispute Settlement Body is the key to a successful transition from GATT to the WTO.

The political payoffs under the WTO are increasing in the accuracy of judgment, γ , achieving full political efficiency when $\gamma = 1$. To show this, I use the envelope theorem. For $\gamma \in [\gamma_1, \gamma_2]$, the government's optimization problem is given by $\max_{s^{Wr}} P^W(2m(\underline{\theta}, \gamma) - s^{Wr}, s^{Wr})$. Apply the envelope theorem to get:

$$\begin{aligned} & \frac{dP^W(2m(\underline{\theta}, \gamma) - s^{Wr}, s^{Wr})}{d\gamma} \\ &= -\rho[u(s^{Wr}; \underline{\theta}) + v(s^{Wr})] + \rho[u(2m(\underline{\theta}, \gamma) - s^{Wr}; \underline{\theta}) + v(2m(\underline{\theta}, \gamma) - s^{Wr})] \\ &\quad + (2(1-\rho) + \rho\gamma)[u'(2m(\underline{\theta}, \gamma) - s^{Wr}; \underline{\theta}) + v'(2m(\underline{\theta}, \gamma) - s^{Wr})] \times 2 \frac{dm(\underline{\theta}, \gamma)}{d\gamma}. \end{aligned}$$

The expression on the second line is positive because

$$\begin{aligned} & u(2m(\underline{\theta}, \gamma) - s^{Wr}; \underline{\theta}) + v(2m(\underline{\theta}, \gamma) - s^{Wr}) \\ &= u(l^{Wr}; \underline{\theta}) + v(l^{Wr}) > u(s^{Wr}; \underline{\theta}) + v(s^{Wr}). \end{aligned}$$

The expression on the third line is also positive because

$$\begin{aligned} & u'(2m(\underline{\theta}, \gamma) - s^{Wr}; \underline{\theta}) + v'(2m(\underline{\theta}, \gamma) - s^{Wr}) \\ &= u'(l^{Wr}; \underline{\theta}) + v'(l^{Wr}; \underline{\theta}) < 0, \end{aligned}$$

and $\frac{dm(\underline{\theta}, \gamma)}{d\gamma} < 0$. For $\gamma > \gamma_2$, the government's optimization problem is given by $\max_{l^{Wu}, s^{Wu}} P^W(l^{Wu}, s^{Wu})$. Applying the envelope theorem yields

$$\frac{dP^W(l^{Wu}, s^{Wu})}{d\gamma} = \rho[u(l^{Wu}; \underline{\theta}) + v(l^{Wu}) - u(s^{Wu}; \underline{\theta}) - v(s^{Wu})] > 0.$$

Political welfare under the WTO for different levels of γ is depicted in Fig. 3. The upper curve depicts $P^W(l^{Wu}, s^{Wu}(\gamma))$, which is the political welfare under the WTO as a function of γ assuming that the incentive constraint (13) is not binding. The lower curve, $P^W(l^{Wr}, s^{Wr}(\gamma))$, represents the political payoff under the WTO when the incentive constraint (13) is binding. These two curves are tangent at $\gamma = \gamma_2$. Furthermore, as was noted in Lemma 3, for $\gamma < \gamma_1$ the negotiated agreement under the WTO is a non-contingent contract which is represented by the line segment ab on the graph. Therefore, political welfare under the WTO is depicted by the segments ab (when tariffs are non-contingent), bc (when the incentive constraint (13) is binding), and cd (when the incentive constraints are not binding).

Political welfare under GATT, $P^G(l^G, s^G)$, which is independent of γ , is represented by a horizontal line in Fig. 3. As depicted on the graph, $P^G(l^G, s^G)$ always lie below the upper curve, $P^W(l^{Wu}, s^{Wu})$, and it intersects with the lower curve, $P^W(l^{Wr}, s^{Wr})$, at $\gamma = \hat{\gamma} \in (\gamma_1, \gamma_2)$. In other words:

Proposition 2. There exists $\hat{\gamma} \in (\gamma_1, \gamma_2)$, such that the negotiated tariffs under the WTO Safeguard Agreement generate a higher expected political payoff than does the negotiated tariffs under the GATT safeguard clause, if and only if $\gamma > \hat{\gamma}$. Moreover, these expected payoffs are equal if and only if $\gamma = \hat{\gamma}$.

⁹ Lemma 3 states that $s^{Wu} < \tau^{PE}(\bar{\theta})$.

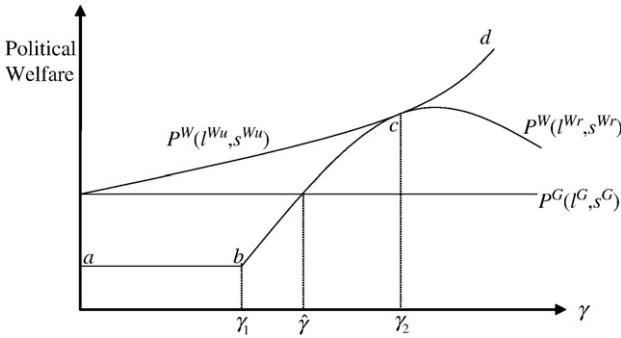


Fig. 3. Comparing expected political welfare under WTO and GATT.

7. Social welfare under WTO vs. GATT

Under the political trade model presented above, trade agreements fall short of social efficiency because governments give unequal weights to the welfare of import-competing sectors and consumers. In fact, reforms in the world trading system can be understood as attempts by governments to improve the political efficiency of their trade partnership but it is not clear if such reforms promote social efficiency as well. In this section, I investigate the effect of reforms in the safeguard clause on social welfare. The social welfare function is defined similar to the political welfare function but with equal weights given to consumers' and producers' surplus.

As was noted in the previous section, the governments' gains from transition to WTO are twofold. First, the Safeguard Agreement of the WTO reduces the pain to the governments from protecting their industries in periods of high political pressure, by restricting the use of the retaliation provision. Second, under the auspices of the Safeguard Agreement, the governments will be protecting their troubled industries more vigorously. The latter channel of political gain is certainly bad news from a social welfare point of view, as a higher rate of protection in any situation translates to lower social welfare.¹⁰ However, social welfare is improved through the former channel of political gains, as lower frequency of trade skirmishes reduces the average rate of retaliatory tariffs. But it turns out that the social costs of the new safeguard clause outweigh its social gains and, thus, social welfare is undermined as a result of the reforms in the safeguard clause:

Proposition 3. Social welfare is higher under the GATT safeguard clause (Article XIX) than under the WTO safeguard clause (the Safeguard Agreement).¹¹

This result, however, should be viewed in the context of this paper where no alternative protectionist measure is allowed to be taken by the negotiating parties. In practice, there are substitute measures for safeguards, such as antidumping, VERs, and hidden trade barriers, that governments can use to diffuse occasional protectionist pressures generated by domestic interest groups. These substitute measures are usually considered worse than safeguards as they are less transparent, violate the MFN principle and generate inefficiency due to trade diversion, and afford higher trade barriers for a longer period of time (Bown, 2002). Therefore, an appropriate framework to analyze the social welfare effect of the Safeguard Agreement is one that recognizes the existence and substitutability of alternative trade barriers. In fact, the new safeguard clause may be more favorable in terms of social

¹⁰ With equal weights on the surplus of consumers and producers (i.e., $\theta=1$), welfare is decreasing in tariffs and the most efficient cooperative tariff rate is zero.

¹¹ This result does not necessarily mean that average tariffs are greater under the WTO than under the GATT. In particular, even if average tariffs are the same under the two systems, social welfare will be lower under the WTO since social welfare is a concave function of tariffs and the low and safeguard tariffs are farther apart under the WTO.

efficiency as it motivates the governments to rely more on safeguard measures in lieu of antidumping, VERs, and hidden trade barriers.¹²

8. Enforcement

Thus far, I have characterized the incentive-compatible trade agreements under GATT and the WTO that maximize the joint political welfare of the negotiating governments. However, a trade agreement should be not only incentive-compatible (i.e., one that induces truthful reporting of the state of the world), but also self-enforcing. In this section, I adopt a repeated-game framework to account for the enforcement issue. If governments are sufficiently patient, the incentive-compatible agreements characterized above are self-enforcing. The minimum level of patience required to sustain an agreement, however, can differ across institutions. Therefore, introducing the enforcement problem can alter our analysis on the relative performance of GATT and the WTO.

Assume that the static games described above are repeated over an infinite number of periods. In each period a new political pressure is realized in each country according to the same random process explained above, i.e., a high (low) pressure is realized with probability ρ ($1-\rho$, respectively). Any observable deviation from the strategy profile prescribed by the agreement will trigger a reversion to Nash tariffs (i.e., a collapse of the agreement) in both sectors and all subsequent periods.

When governments set tariffs non-cooperatively, a government's best option is to set $\tau^N(\bar{\theta})$ on the imports of the sector where political pressure is high, and to set $\tau^N(\underline{\theta})$ on the imports of the sector with low political pressure. Denoting the expected per-period welfare of the government when there is no cooperation by P^N , we can write the discounted future value of cooperation under agreement $A = \{W, G\}$ as $\frac{\delta}{1-\delta}(P^A - P^N)$, where δ is the common discount factor of the governments.

To characterize the self-enforcing conditions for each institution we also need to derive the government's one-period payoff from cheating. To this end, note that the government's one-period payoff from cheating depends on the realization of the political shocks. If the government faces a high political pressure and considers cheating, it will be a dominant strategy to lie about the actual political pressure in addition to setting non-cooperative tariffs. That is because by disclosing high political pressure, the government will be subject to potential retaliations in the current period. In contrast, for a government that faces low political pressure, the decision to deviate from the agreement can be made after the announcement of political shocks by the parties (and the DSB's ruling in case of the WTO agreement).

Therefore, letting $C^A(\bar{\theta})$ denote the government's one-period payoff from cheating under agreement $A = \{W, G\}$ and high political pressure, we have

$$C^G(\bar{\theta}) \equiv [u(\tau^N(\bar{\theta}), \bar{\theta}) + v(l^G) + u(\tau^N(\underline{\theta}), \underline{\theta}) + (1-\rho)v(l^G) + \rho v(s^G)] \\ - [u(s^G, \bar{\theta}) + v(s^G) + (1-\rho)(u(l^G, \underline{\theta}) + v(l^G)) + \rho(u(s^G, \underline{\theta}) + v(s^G))],$$

and

$$C^W(\bar{\theta}) \equiv [u(\tau^N(\bar{\theta}), \bar{\theta}) + v(l^W) + u(\tau^N(\underline{\theta}), \underline{\theta}) + (1-\rho)v(l^W) + \rho v(s^W)] \\ - [u(s^W, \bar{\theta}) + \gamma v(l^W) + (1-\gamma)v(s^W) + (1-\rho)(u(l^W, \underline{\theta}) + v(l^W)) \\ + \rho(\gamma u(l^W, \underline{\theta}) + (1-\gamma)u(s^W, \underline{\theta}) + v(s^W))]$$

In each of these identities, the first bracket represents the government's one-period welfare when it reverts to non-cooperative

¹² As will be seen in the next section, in a non-cooperative environment there is another channel through which political as well as social welfare can be improved by switching to the WTO.

tariffs and the second bracket represents the government's one-period welfare when it cooperates.

As noted above, for the case where $\theta = \underline{\theta}$, the government can wait until the uncertainty about the other country's political parameter is resolved before considering deviation. The payoff from cheating, therefore, will depend on the announcement of the other country and, in case of the WTO agreement, on the DSB's ruling as well. To investigate these various self-enforcement conditions under the WTO, let $C^W(\underline{\theta}, \theta^*, \tilde{\theta})$ denote the government's one-period payoff from cheating when it faces a low political pressure, the announced political pressure in the foreign country is θ^* , and the court's ruling (if any) about the foreign country's announcement is $\tilde{\theta}$. Therefore,

- WTO self-enforcement conditions:

$$C^W(\bar{\theta}) \leq \frac{\delta}{1-\delta} (P^W - P^N). \quad (16)$$

$$C^W(\underline{\theta}, \theta^*, \tilde{\theta}) \leq \frac{\delta}{1-\delta} (P^W - P^N); \forall \theta^*, \tilde{\theta}. \quad (17)$$

Inequality (17) represents three self-enforcement conditions for the cases where $(\theta^* = \bar{\theta}, \tilde{\theta} = \bar{\theta})$, $(\theta^* = \bar{\theta}, \tilde{\theta} = \underline{\theta})$, and $(\theta^* = \underline{\theta})$. The payoff from cheating under these conditions can be ranked as follows.

Lemma 8. $C^W(\underline{\theta}, \underline{\theta}, \tilde{\theta}) = C^W(\underline{\theta}, \bar{\theta}, \bar{\theta}) > C^W(\underline{\theta}, \bar{\theta}, \underline{\theta})$.

This lemma implies that condition (16) and $C^W(\underline{\theta}, \underline{\theta}, \tilde{\theta}) \leq \frac{\delta}{1-\delta} (P^W - P^N)$ are sufficient conditions for self-enforceability of the WTO.

Now let $C^G(\underline{\theta}, \theta^*)$ denote the government's one-period payoff under the GATT from cheating when it faces a low political pressure, and the announced political pressure in the foreign country is θ^* . Therefore,

- GATT self-enforcement conditions:

$$C^G(\bar{\theta}) \leq \frac{\delta}{1-\delta} (P^G - P^N). \quad (18)$$

$$C^G(\underline{\theta}, \theta^*) \leq \frac{\delta}{1-\delta} (P^G - P^N); \forall \theta^*. \quad (19)$$

Inequality (19) represents two self-enforcement conditions for the cases where $\theta^* = \bar{\theta}$ and $\theta^* = \underline{\theta}$, respectively. The payoff from cheating under these conditions can be ranked as follows.

Lemma 9. $C^G(\underline{\theta}, \underline{\theta}) > C^G(\underline{\theta}, \bar{\theta})$.

This lemma implies that condition (18) and $C^G(\underline{\theta}, \underline{\theta}) \leq \frac{\delta}{1-\delta} (P^G - P^N)$ are sufficient conditions for self-enforceability of the GATT.

Now we are ready to compare the self-enforceability of the WTO and GATT. Let δ^G denote the minimum discount factor for which (I^G, s^G) is self-enforcing under the GATT. Similarly, define $\delta^W(\gamma)$ as the minimum discount factor for which (I^W, s^W) is self-enforcing under the WTO when judgment quality is γ . Now recall from Proposition 2 that the value of cooperation is the same across the institutions, i.e., $P^G = P^W$, when the WTO judgment quality is at its critical level, $\hat{\gamma}$. Moreover,

Lemma 10. For $\gamma = \hat{\gamma}$ we have a) $C^G(\underline{\theta}, \underline{\theta}) > C^W(\underline{\theta}, \underline{\theta}, \tilde{\theta})$ and b) $C^G(\bar{\theta}) > C^W(\bar{\theta})$.

Therefore,

Proposition 4. For $\delta = \delta^G$ and $\gamma = \hat{\gamma}$, the WTO's self-enforcement conditions are not binding and, therefore, $\delta^W(\hat{\gamma}) < \delta^G$.

This proposition is interesting in that it states when the value of cooperation is equal across the two institutions, sustaining cooper-

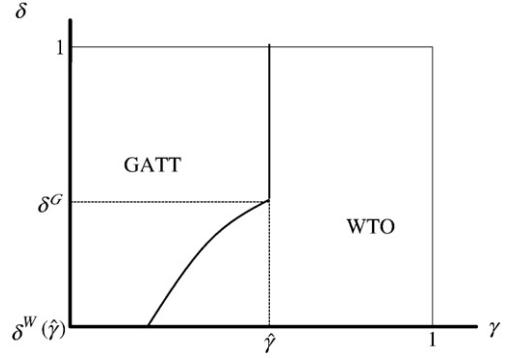


Fig. 4. For impatient governments (i.e., when $s^W(\hat{\gamma}) < \delta < \delta^G$), WTO outperforms GATT for a larger range of γ .

ation is easier under the WTO than under GATT. This analysis suggests that the Dispute Settlement Body of the WTO can improve the enforceability of trade agreements despite the fact that it does not provide any external enforcement.

Corollary 1. If $\delta^W(\hat{\gamma}) \leq \delta < \delta^G$, the minimum judgment quality for which the political welfare is higher under the WTO than under GATT is less than $\hat{\gamma}$.¹³

This corollary is shown in Fig. 4. For $\delta > \delta^G$, the critical value of γ is what we obtained under full commitment, i.e., $\gamma = \hat{\gamma}$. However, as δ falls below δ^G , the critical value of γ above which the WTO outperforms GATT, decreases. Therefore, for this intermediate range of discount factors the WTO enhances the political efficiency of trade agreements by improving their self-enforceability.

9. Optimal DSB

So far I have assumed that the only role for the WTO court is to generate a public signal by announcing the result of its investigations. This ruling mechanism, however, does not necessarily maximize the joint welfare of the WTO member countries. In this section, I take a mechanism design approach (with the restriction that the authorized retaliation must be reciprocal) to characterize the court's ruling behavior that maximizes the expected joint political welfare.

I assume that after observing $\tilde{\theta}$, the court rules in favor of the defendant with probability $r(\tilde{\theta})$. Letting $\alpha \equiv r(\bar{\theta})$ and $\beta \equiv r(\underline{\theta})$, the expected joint political welfare can be written as follows

$$\begin{aligned} W(l, s, \alpha, \beta) \equiv & 2(1-\rho)[u(l; \underline{\theta}) + v(l)] \\ & + \rho[u(s; \bar{\theta}) + v(s)] \\ & + \rho\gamma(\alpha[u(l; \underline{\theta}) + v(l)] + (1-\alpha)[u(s; \underline{\theta}) + v(s)]) \\ & + \rho(1-\gamma)(\beta[u(l; \underline{\theta}) + v(l)] + (1-\beta)[u(s; \underline{\theta}) + v(s)]). \end{aligned} \quad (20)$$

The first line on the right hand side of Eq. (20) represents the joint political welfare of the governments when the home country is facing a low political pressure, weighted by the probability of low pressure. The remaining terms on the right hand side represent the expected joint welfare when the home country faces high pressure, weighted appropriately. The second line is the joint welfare effect of a safeguard tariff at home. The third and forth lines in Eq. (20) represent the expected joint welfare effect of the foreign country's tariffs, which are determined based on the DSB's rulings. In particular, the third line is the expected joint political welfare from the foreign country's tariff when the court

¹³ No clear conclusion was obtained for $\delta < \delta^W(\hat{\gamma})$. Therefore, I restrict my attention to $\delta > \delta^W(\hat{\gamma})$.

receives a *high-pressure* signal, which happens with probability γ . In this case, with probability α the foreign country will have to impose the low tariff (l), and with probability $(1 - \alpha)$ it will be authorized to impose the retaliatory tariff (s). Similarly, the last line in Eq. (20) represents the expected joint political welfare from the foreign country's tariff when the court receives a *low-pressure* signal. Identity (20) can be simplified as follows:

$$\begin{aligned} W(l, s, \alpha, \beta) &\equiv \rho [u(s; \bar{\theta}) + v(s) + [\gamma(1-\alpha) + (1-\gamma)(1-\beta)][u(s; \underline{\theta}) + v(s)]] \\ &\quad + [2(1-\rho) + \rho\gamma\alpha + \rho(1-\gamma)\beta][u(l; \underline{\theta}) + v(l)]. \end{aligned}$$

The incentive compatibility constraints when the home country faces low and high political pressure, respectively, are given as follows:

$$\begin{aligned} u(s; \underline{\theta}) + (1-\gamma)[\alpha v(l) + (1-\alpha)v(s)] + \gamma[\beta v(l) + (1-\beta)v(s)] \\ \leq u(l; \underline{\theta}) + v(l), \end{aligned} \quad (21)$$

and

$$\begin{aligned} u(s; \bar{\theta}) + \gamma[\alpha v(l) + (1-\alpha)v(s)] + (1-\gamma)[\beta v(l) + (1-\beta)v(s)] \\ \geq u(l; \bar{\theta}) + v(l). \end{aligned} \quad (22)$$

The following proposition summarizes the optimal ruling strategy.

Proposition 5. There exist $\frac{1}{2} < \bar{\gamma}_1 \leq \bar{\gamma}_2 < 1$ such that

$$\begin{cases} 0 < \alpha < 1, \beta = 0 & \text{if } \gamma < \bar{\gamma}_1, \\ \alpha = 1, \beta = 0 & \text{if } \bar{\gamma}_1 \leq \gamma \leq \bar{\gamma}_2, \\ \alpha = 1, 0 < \beta < 1 & \text{if } \gamma > \bar{\gamma}_2. \end{cases}$$

Fig. 5 illustrate this proposition. The vertical axis is the probability of a pro-defendant ruling by the court and the horizontal axis is the court's judgment quality. In comparison with the ruling behavior of a public signalling device, an optimal court shows a pro-complainant bias when γ is sufficiently small, while for a large γ the optimal court shows a pro-defendant bias. Formally,

Corollary 2. The optimal court is pro-defendant if $\gamma > \bar{\gamma}_2$, and is pro-complainant if $\gamma < \bar{\gamma}_1$.

The Proof of Proposition 5 is provided in Appendix A but an intuition of this result can be given here. Recall that for sufficiently high accuracy of judgment, the incentive compatibility constraints are not binding when the court's only role is to reveal the result of its investigations (Lemma 5). When the incentive compatibility constraint is not binding, a lower probability of a trade skirmish, or equivalently, a higher probability of pro-defendant ruling, would still ensure incentive compatibility. Under these situations, the court can improve the welfare of the parties by adopting a pro-defendant bias

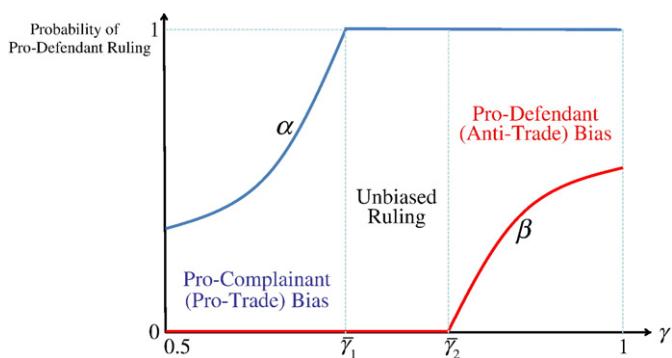


Fig. 5. Optimal ruling as a function of judgment accuracy.

because such a ruling strategy reduces the rate of trade skirmishes without violating the incentive compatibility constraint. On the other hand, the incentive compatibility constraint is binding under a pure public signalling court with low judgment quality. By taking a pro-complainant bias, the court can relax this constraint and let the parties choose tariffs that are more politically efficient.

Maintaining a biased legal system may seem impractical. However, the quasi-legal system of the WTO may be able to generate a systematic anti-trade or pro-trade bias by carefully allocating the burden of proof on the appropriate party.¹⁴

10. Concluding remarks

This paper provides a model of the WTO Dispute Settlement Body as an imperfect public signalling device that enables the governments to condition their tariff policies on a public signal of the state of the world; in contrast, no such signal is available under GATT. I have found that the introduction of the DSB improves the political welfare of the governments by reducing the frequency of trade skirmishes and by improving the self-enforceability of trade agreements. Moreover, I found that an optimal ruling pattern by the DSB constitute a pro-defendant (pro-complainant) bias if its signal is sufficiently accurate (inaccurate).

In this paper, truthful revelation of private information is ensured by the threat of (potential) retaliation following the adoption of a safeguard measure. There are however other truthful mechanisms that are not based on retaliation threats. For example, Bagwell and Staiger (2005) show that a "dynamic constraint" on the use of the safeguard measures, which restricts the number of times that a safeguard measure can be adopted in a given time interval, can also prevent parties from using the safeguard measures opportunistically.

In an extended version of this paper (Beshkar, 2007), I discuss other potential extensions of the present model. This includes considering pre-trial negotiation between the disputing parties (along the lines of Beshkar, 2008), which is a settlement bargaining in the shadow of the DSB, and the implication of contract incompleteness for implementation of the mechanisms that were introduced in this paper (along the lines of Horn et al., 2010).

Appendix A

It is straightforward to calculate the consumer and producer surplus as a function of the tariffs. See the extended version of the paper (Beshkar, 2007) for complete details.

Welfare functions

The politically weighted welfare from the importing sector in home country is given by

$$u(\tau; \theta) = \frac{1}{(3+b)^2} \left\{ \frac{1}{2}(1+b)^2 + 2\theta + [2\theta(1+b) - 4]\tau + \left[\frac{1+\theta}{2}(1+b)^2 - 2(3+b)(1+b) \right] \tau^2 \right\}.$$

Moreover, the home government's welfare from the exporting sector is:

$$v(\tau^*) = \frac{1}{(3+b)^2} \left\{ \frac{(1+b)^2}{2} + 2b + 2(1-b)\tau^* + 2(1+b)\tau^{*2} \right\}.$$

¹⁴ For a discussion on the allocation of the burden of proof in the WTO, see Grando (2006).

For further use note that

$$u'(\tau; \theta) + v'(\tau) = \frac{(1+b)}{(3+b)^2} \{2(\theta-1) + (\theta(1+b)-3b-7)\tau\}. \quad (23)$$

□

Non-prohibitive tariffs

Non-cooperative (Nash) tariff, τ^N , is given by $\tau^N = \frac{2\theta(1+b)-4}{11-\theta+2(7-\theta)b+(3-\theta)b^2}$. Import tariffs are non-prohibitive if and only if $M(p_x) = \frac{b-1-2(1+b)\tau}{3+b} > 0$, or, equivalently if and only if $\tau < \frac{b-1}{2(1+b)}$. Therefore all $\tau \leq \tau^N(\theta)$ are non-prohibitive if and only if $\frac{2\theta(1+b)-4}{11-\theta+2(7-\theta)b+(3-\theta)b^2} < \frac{b-1}{2(1+b)}$, or $\theta < \frac{3b-1}{1+b}$, which is always satisfied under [Assumption 1](#). □

Proof of Lemma 1. It is sufficient to show that when $\theta < \frac{2}{5} \frac{4b+1}{b+1}$ we have $u''(\tau; \theta) < 0$, $u'(0; \theta) > 0$, $v''(\tau^*) > 0$, and $v'(0) < 0$. $u''(\tau; \theta)$ is negative iff $11+3b-\theta(b+1) > 0$, or $\theta < \frac{11+3b}{b+1}$, which holds because $\frac{11+3b}{b+1} > \frac{2}{5} \frac{4b+1}{b+1}$. Also, $u'(0; \theta) = \frac{2\theta(1+b)-4}{(3+b)^2}$ is positive iff $\theta > \frac{2}{1+b}$, which holds since $b > 1$ and $\theta > 1$. Moreover, $v'(0) = \frac{2(1-b)}{(3+b)^2} < 0$ because $b > 1$. Finally, $v''(\tau^*) = \frac{4(1+b)}{(3+b)^2} > 0$. □

Proof of Lemma 2. Take the total derivative of the FOC that characterizes $\tau^N(\theta)$, with respect to τ^N and θ , to obtain: $[\psi''_x(\tau^N) + \theta\pi''_x(\tau^N) + T''(\tau^N)]d\tau^N + \pi'_x(\tau^N)d\theta = 0$. Rearranging yields $\frac{d\tau^N}{d\theta} = -\frac{\pi'_x(\tau^N)}{[\psi'_x(\tau^N) + \theta\pi'_x(\tau^N) + T'(\tau^N)]}$. This ratio is positive because both the numerator and the denominator have negative values. Similarly, it can be shown that $\frac{d\tau^{PE}}{d\theta} > 0$. □

Proof of Lemma 3. Note that $P^W(l, s)$ is additively separable in functions of l and s , and we can write

$$l^{Wu} \equiv \arg \max_l [u(l; \underline{\theta}) + v(l)] = \tau^E(\underline{\theta}), \quad (24)$$

$$s^{Wu} \equiv \arg \max_s \{[u(s; \bar{\theta}) + v(s)] + (1-\gamma)[u(s; \underline{\theta}) + v(s)]\}. \quad (25)$$

To verify that $\tau^{PE}(\underline{\theta}) < s^{Wu} \leq \tau^{PE}(\bar{\theta})$, it is sufficient to show that the concave function $[u(s; \bar{\theta}) + v(s)] + (1-\gamma)[u(s; \underline{\theta}) + v(s)]$ is increasing when $s = \tau^{PE}(\underline{\theta})$ and decreasing when $s = \tau^{PE}(\bar{\theta})$. I do this by taking first derivative of this function and evaluating it at $\tau^{PE}(\underline{\theta})$ and $\tau^{PE}(\bar{\theta})$:

$$\begin{aligned} & [u'(\tau^{PE}(\underline{\theta}); \bar{\theta}) + v'(\tau^{PE}(\underline{\theta}))] + (1-\gamma)[u'(\tau^{PE}(\underline{\theta}); \underline{\theta}) + v'(\tau^{PE}(\underline{\theta}))] \\ &= [u'(\tau^{PE}(\underline{\theta}); \bar{\theta}) + v'(\tau^{PE}(\underline{\theta}))] > 0, \end{aligned}$$

and

$$\begin{aligned} & [u'(\tau^{PE}(\bar{\theta}); \bar{\theta}) + v'(\tau^{PE}(\bar{\theta}))] + (1-\gamma)[u'(\tau^{PE}(\bar{\theta}); \underline{\theta}) + v'(\tau^{PE}(\bar{\theta}))] \\ &= (1-\gamma)[u'(\tau^{PE}(\bar{\theta}); \underline{\theta}) + v'(\tau^{PE}(\bar{\theta}))] < 0. \end{aligned}$$

To verify that s^{Wu} is increasing in γ , write the first-order condition that characterizes s^{Wu} :

$$[u'(s^{Wu}; \bar{\theta}) + v'(s^{Wu})] + (1-\gamma)[u'(s^{Wu}; \underline{\theta}) + v'(s^{Wu})] = 0,$$

and take its total derivative with respect to s^{Wu} and γ , and rearrange to obtain:

$$\frac{ds^{Wu}}{d\gamma} = \frac{u'(\underline{\theta}) + v'(s^{Wu})}{[u''(s^{Wu}; \bar{\theta}) + v''(s^{Wu})] + (1-\gamma)[u''(s^{Wu}; \underline{\theta}) + v''(s^{Wu})]} > 0.$$

This ratio is positive because both the numerator and the denominator have negative values. □

Proof of Lemma 4. $u(\tau; \theta) + \alpha v(\tau)$ is concave because $u''(\tau; \theta) + \alpha v''(\tau) = -\frac{(1+b)[-4\alpha + (11+3b)-\theta(b+1)]}{(3+b)^2} < 0$, for $0 < \alpha < 1$ and the parameter range specified in [Assumption 1](#) i.e., $(\theta < \frac{2}{5} \frac{4b+1}{b+1})$. Moreover, $u(\tau; \theta) + \alpha v(\tau)$ is a quadratic function and, thus, symmetric around $m(\theta, \alpha)$. □

Proof of Lemma 6. According to [Lemma 5](#), the incentive constraint (13) is binding for $\gamma < \gamma_2$, i.e. $u(s; \underline{\theta}) + \gamma v(s) = u(l; \underline{\theta}) + \gamma v(l)$. Since $u(\tau; \underline{\theta}) + \gamma v(\tau)$ is concave in τ and symmetric around $\tau = m(\underline{\theta}, \gamma)$, the above equality holds iff $l+s = 2m(\underline{\theta}, \gamma)$ or $l=s$. Define γ_1 as the solution to $s^{Wu}(\gamma) = m(\underline{\theta}, \gamma)$ when solving for γ . This equation has a unique solution since $\frac{ds^{Wu}(\gamma)}{d\gamma} > 0$, $\frac{dm(\underline{\theta}, \gamma)}{d\gamma} < 0$, $s^{Wu}(0) < m(\underline{\theta}, 0)$, and $s^{Wu}(1) > m(\underline{\theta}, 1)$. In other words, there exists $\gamma_1 \in (0, 1)$ such that

$$\begin{aligned} s^{Wu}(\gamma) &< m(\underline{\theta}, \gamma) \text{ if } \gamma < \gamma_1, \\ s^{Wu}(\gamma) &= m(\underline{\theta}, \gamma) \text{ if } \gamma = \gamma_1, \\ s^{Wu}(\gamma) &> m(\underline{\theta}, \gamma) \text{ if } \gamma > \gamma_1. \end{aligned}$$

Moreover, we have $\gamma_1 < \gamma_2$. To show this, it is sufficient to show that $s^{Wu}(\gamma_2) > m(\underline{\theta}, \gamma_2)$. But, by the definition of γ_2 , we have $s^{Wu}(\gamma_2) = 2m(\underline{\theta}, \gamma_2) - l^{Wu}$ which implies that $s^{Wu}(\gamma_2) = 2m(\underline{\theta}, \gamma_2) - m(\underline{\theta}, 1) > m(\underline{\theta}, \gamma_2)$.

Finally note that, having fixed γ and ρ , $P^W(l, s)$ increases when $|l - l^{Wu}|$ and/or $|s - s^{Wu}|$ decreases, and $P^W(l, s)$ is maximized when $l = l^{Wu}$ and $s = s^{Wu}$. Now we are ready to prove the lemma.

First I show that when $\gamma_1 \leq \gamma \leq \gamma_2$, the solution to the negotiators' problem, satisfy $l+s = 2m(\underline{\theta}, \gamma)$. On the contrary suppose that $l+s \neq 2m(\underline{\theta}, \gamma)$, which implies that $l=s \equiv \tau_0$. Moreover, when $\gamma_1 \leq \gamma \leq \gamma_2$ we have $l^{Wu} < m(\underline{\theta}, \gamma) < s^{Wu}(\gamma)$. Therefore, one of the following should hold:

$$\begin{aligned} \tau_0 &\leq l^{Wu} < m(\underline{\theta}, \gamma) < s^{Wu}(\gamma), \\ l^{Wu} &< \tau_0 < m(\underline{\theta}, \gamma) < s^{Wu}(\gamma), \\ l^{Wu} &< m(\underline{\theta}, \gamma) \leq \tau_0 < s^{Wu}(\gamma), \\ l^{Wu} &< m(\underline{\theta}, \gamma) < s^{Wu}(\gamma) \leq \tau_0. \end{aligned}$$

In the first two cases, setting $l=\tau_0$ and $s=2m(\underline{\theta}, \gamma) - \tau_0$ will be incentive compatible and will generate a higher political welfare than $l=s=\tau_0$, because $|2m(\underline{\theta}, \gamma) - \tau_0 - s^{Wu}| < |\tau_0 - s^{Wu}|$. In the latter cases, setting $s=\tau_0$ and $l=2m(\underline{\theta}, \gamma) - \tau_0$ will be incentive compatible and will generate a higher political welfare than $l=s=\tau_0$, because $|2m(\underline{\theta}, \gamma) - \tau_0 - l^{Wu}| < |\tau_0 - l^{Wu}|$.

Finally, when $\gamma < \gamma_1$, the solution to the WTO negotiators' problem must satisfy $l=s$. On the contrary, suppose that $l \neq s$ which implies that $l+s = 2m(\underline{\theta}, \gamma)$. I will show that (l, l) generates a higher payoff than (l, s) by proving that $|l - s^{Wu}| < |s - s^{Wu}|$. Since $l^{Wu} < s^{Wu}(\gamma) < m(\underline{\theta}, \gamma)$ and $l+s = 2m(\underline{\theta}, \gamma)$, one of the following should hold:

$$\begin{aligned} l &< s^{Wu} < m(\underline{\theta}, \gamma) < s, \\ \text{or } s^{Wu} &< l < m(\underline{\theta}, \gamma) < s. \end{aligned}$$

If the former holds, we have $|l - s^{Wu}| < |s - s^{Wu}|$ because $0 < s^{Wu} - l < m(\underline{\theta}, \gamma) - l + m(\underline{\theta}, \gamma) - s^{Wu} = s - s^{Wu}$. If the latter holds, again we have $|l - s^{Wu}| < |s - s^{Wu}|$ because $0 < l - s^{Wu} < s - s^{Wu}$. \square

Proof of Lemma 7. According to Lemma 6, when $\gamma_1 < \gamma < \gamma_2$, the optimal solution to Eq. (15) is given by (l^{Wr}, s^{Wr}) , where $l^{Wr} + s^{Wr} = 2m(\underline{\theta}, \gamma)$. Therefore, problem (15) can be written as

$$\begin{aligned} \max_s P^W(2m(\underline{\theta}, \gamma) - s, s) \\ \equiv \max_s \rho[u(s; \bar{\theta}) + v(s)] + \rho(1-\gamma)[u(s; \underline{\theta}) + v(s)] \\ + (2(1-\rho) + \rho\gamma)[u(2m(\underline{\theta}, \gamma) - s; \underline{\theta}) + v(2m(\underline{\theta}, \gamma) - s)], \end{aligned}$$

and the FOC is given by

$$\begin{aligned} \frac{dP^W(2m(\underline{\theta}, \gamma) - s, s)}{ds} = \rho[u'(s; \bar{\theta}) + v'(s)] + \rho(1-\gamma)[u'(s; \underline{\theta}) + v'(s)] \\ - (2(1-\rho) + \rho\gamma)[u'(2m(\underline{\theta}, \gamma) - s; \underline{\theta}) + v'(2m(\underline{\theta}, \gamma) - s)] = 0. \end{aligned}$$

It is sufficient to show that an optimal solution cannot contain $s^{Wr} \leq s^{Wu}$ or $l^{Wr} \leq l^{Wu}$.

Suppose that $s^{Wr} \leq s^{Wu}$. This implies that $\rho[u'(s^{Wr}; \bar{\theta}) + v'(s^{Wr})] + \rho(1-\gamma)[u'(s^{Wr}; \underline{\theta}) + v'(s^{Wr})] > 0$. It also implies that $l^{Wr} = 2m(\underline{\theta}, \gamma) - s^{Wr} > l^{Wu}$ since when $\gamma_1 < \gamma < \gamma_2$ we have $s^{Wu} < 2m(\underline{\theta}, \gamma) - l^{Wu}$. Thus, $u'(2m(\underline{\theta}, \gamma) - s^{Wr}; \underline{\theta}) + v'(2m(\underline{\theta}, \gamma) - s^{Wr}) < 0$. Therefore, $\frac{dP^W(2m(\underline{\theta}, \gamma) - s^{Wr}, s^{Wr})}{ds} > 0$ and the optimality condition is not satisfied. Thus, $s^{Wr} > s^{Wu}$.

Now suppose that $l^{Wr} \leq l^{Wu}$. This implies that $2m(\underline{\theta}, \gamma) - s^{Wr} \leq l^{Wu}$ and that $u'(2m(\underline{\theta}, \gamma) - s^{Wr}; \underline{\theta}) + v'(2m(\underline{\theta}, \gamma) - s^{Wr}) > 0$. It also implies that $s^{Wr} = 2m(\underline{\theta}, \gamma) - l^{Wr} > s^{Wu}$. Thus $\rho[u'(s^{Wr}; \bar{\theta}) + v'(s^{Wr})] + \rho(1-\gamma)[u'(s^{Wr}; \underline{\theta}) + v'(s^{Wr})] < 0$. Therefore, $\frac{dP^W(2m(\underline{\theta}, \gamma) - s^{Wr}, s^{Wr})}{ds} < 0$ and the optimality condition is not satisfied. Thus, $l^{Wr} > l^{Wu}$. \square

Proof of Proposition 2. For $\gamma=0$ we have $P^W(l, s) \equiv P^G(l, s)$ which implies that $l^{Wu} = l^G$ and $s^{Wu} = s^G$. It then follows that for $\gamma=0$ we have $P^W(l^{Wu}, s^{Wu}) = P^G(l^G, s^G)$. Moreover $P^W(l^{Wu}, s^{Wu})$ is increasing in γ , while $P^G(l^G, s^G)$ is independent of γ . This proves that $P^G(l^G, s^G)$ is below $P^W(l^{Wu}, s^{Wu})$ for $\gamma \in (0, 1]$.

To verify that $\gamma_1 < \gamma < \gamma_2$, it is now sufficient to show $P^W(l^{Wr}(\gamma_1), s^{Wr}(\gamma_1)) < P^G(l^G, s^G)$, and $P^W(l^{Wr}(\gamma_2), s^{Wr}(\gamma_2)) > P^G(l^G, s^G)$. But note that $P^W(l^{Wr}(\gamma_1), s^{Wr}(\gamma_1))$ is equal to the highest payoffs attainable under a non-contingent agreement and it must be smaller than the government's payoff under GATT (because any non-contingent agreement is feasible, i.e., incentive compatible, under the GATT rules). Moreover, $l^{Wr}(\gamma_2) = l^{Wu}$ and $s^{Wr}(\gamma_2) = s^{Wu}(\gamma_2)$ and, thus, $P^W(l^{Wr}(\gamma_2), s^{Wr}(\gamma_2))$ is equal to $P^W(l^{Wu}(\gamma_2), s^{Wu}(\gamma_2))$ which is larger than $P^G(l^G, s^G)$. \square

Lemma 11. If $\underline{\theta} = 1$, then $s^{Wu} = \frac{2(1-\bar{\theta})}{\bar{\theta}(1+b) + 2\gamma(b+3) - 13 - 5b}$, and $\frac{ds^{Wu}}{d\gamma} = \frac{4(b+3)(\bar{\theta}-1)}{(\theta(1+b) + 2\gamma(b+3) - 13 - 5b)^2}$.

Proof. Substituting Eq. (23) into the FOC associated with Eq. (25) yields

$$\begin{aligned} -2(1-\bar{\theta}) + (\bar{\theta}(1+b) - 3b - 7)s^{Wu} \\ + (1-\gamma)[-2(1-\underline{\theta}) + (\underline{\theta}(1+b) - 3b - 7)s^{Wu}] = 0. \quad \square \end{aligned}$$

Solving for s^{Wu} and taking its derivative with respect to γ (assuming $\underline{\theta} = 1$) yields the stated results.

Proof of Proposition 3. Social welfare under GATT, denoted by S^G , can be written as follows:

$$S^G = 2\{\rho[u(s^G; 1) + v(s^G)] + (1-\rho)[u(l^G; 1) + v(l^G)]\}.$$

This is identical to the political welfare under GATT if $\underline{\theta} = \bar{\theta} = 1$. Similarly, social welfare under the WTO, denoted by S^W , is given by:

$$S^W(\gamma) = \begin{cases} S^{Wr}(\gamma) & \text{if } \gamma_1 < \gamma < \gamma_2, \\ S^{Wu}(\gamma) & \text{if } \gamma > \gamma_2, \end{cases}$$

where,

$$\begin{aligned} S^{Wr}(\gamma) &= \rho(2-\gamma)[u(s^{Wr}; 1) + v(s^{Wr})] + (2(1-\rho) + \rho\gamma)[u(l^{Wr}; 1) + v(l^{Wr})], \\ S^{Wu}(\gamma) &= \rho(2-\gamma)[u(s^{Wu}; 1) + v(s^{Wu})] + (2(1-\rho) + \rho\gamma)[u(l^{Wu}; 1) + v(l^{Wu})]. \end{aligned}$$

To prove the proposition (i.e., $S^W(\gamma) < S^G \forall \gamma \in (\gamma_1, 1)$), it is sufficient to show that $S^{Wu}(\gamma) < S^G \forall \gamma \in (0, 1]$ and that $S^{Wr}(\gamma) < S^{Wu}(\gamma) \forall \gamma \in [0, \gamma_2]$.

I show the former, by proving that $S^{Wu}(0) = S^G$ and $\frac{dS^{Wu}(\gamma)}{d\gamma} < 0 \forall \gamma \in (0, 1]$. Note from Eqs. (9) and (24) that $l^{Wu}(\gamma) = l^G \forall \gamma$. Also, comparing Eqs. (10) and (25) yields $s^{Wu}(0) = s^G$. Therefore,

$$S^{Wu}(0) = 2\{[u(s^G; 1) + v(s^G)] + (1-\rho)[u(l^G; 1) + v(l^G)]\} = S^G.$$

Noting that $u(\tau; 1) + v(\tau) = \frac{(1+b)(1-\tau^2)}{(3+b)}$, $S^{Wu}(\gamma)$ can be written as follows:

$$S^{Wu}(\gamma) = \frac{(1+b)}{(3+b)} \left(2 - \rho(2-\gamma)(s^{Wu})^2 - (2(1-\rho) + \rho\gamma)(l^{Wu})^2 \right).$$

Taking derivative yields

$$\frac{dS^{Wu}(\gamma)}{d\gamma} = \frac{\rho(1+b)}{(3+b)} \left((s^{Wu})^2 - 2(2-\gamma)s^{Wu} \frac{ds^{Wu}}{d\gamma} - (l^{Wu})^2 \right).$$

Substitute for s^{Wu} and $\frac{ds^{Wu}}{d\gamma}$ from Lemma 11 to get:

$$\begin{aligned} \frac{dS^{Wu}(\gamma)}{d\gamma} &= \left(\frac{\rho(1+b)}{(3+b)} \right) \left(\frac{2(\bar{\theta}-1)}{\bar{\theta}(1+b) + 2\gamma(b+3) - 13 - 5b} \right)^2 \\ &\times \left(\frac{\bar{\theta}(1+b) + 3b + 11 - 2\gamma(b+3)}{\bar{\theta}(1+b) - 13 - 5b + 2\gamma(b+3)} \right). \end{aligned}$$

The first two parentheses are obviously positive. The fraction in the third parenthesis has a positive numerator (since $\gamma \leq 1$) but a negative denominator ([Assumption 1](#) guarantees a negative sign for this denominator). Therefore, $\frac{dS^{Wu}(\gamma)}{d\gamma} < 0$.

To show that $S^{Wr}(\gamma) < S^{Wu}(\gamma) \forall \gamma \in [0, \gamma_2]$, first note that for $\gamma < \gamma_2$ the incentive constraint given by $s + l \geq 2m(\underline{\theta}, \gamma)$ is binding, which implies $s^{Wu} + l^{Wu} < 2m(\underline{\theta}, \gamma)$, $s^{Wr} + l^{Wr} = 2m(\underline{\theta}, \gamma)$, and $s^{Wu} + l^{Wu} < s^{Wr} + l^{Wr}$. It then follows that $s^{Wu} < s^{Wr}$ and $l^{Wu} < l^{Wr}$, because if $s^{Wu} > s^{Wr}$ and $l^{Wu} < l^{Wr}$ the political welfare in case of a binding constraint can be raised by increasing s^{Wr} , and if $s^{Wu} < s^{Wr}$ and $l^{Wu} > l^{Wr}$ political welfare in case of a binding constraint can be raised by increasing l^{Wr} . Therefore, $S^{Wr}(\gamma) < S^{Wu}(\gamma) \forall \gamma \in [0, \gamma_2]$. \square

Proof of Lemma 8. First consider the cases where $\theta^* = \underline{\theta}$ and $(\theta^* = \bar{\theta}, \tilde{\theta} = \bar{\theta})$, respectively. In each of these cases, the home government is supposed to set both of its import tariffs at the low agreement level according to the WTO agreement. Therefore, under these two cases the home government has the same payoff from cheating. However, when $(\theta^* = \bar{\theta}, \tilde{\theta} = \underline{\theta})$ the home country is allowed to impose high tariff (as a form of retaliation) in one sector but a low tariff in the other sector. Therefore, compared to the former two cases, the home government has a lower payoff from cheating when $(\theta^* = \bar{\theta}, \tilde{\theta} = \underline{\theta})$. \square

Proof of Lemma 9. Under the GATT when the foreign country announces a high shock, the home country is authorized to impose a retaliatory tariff, which is higher than the normal tariff. Therefore, a government receives a lower payoff from cheating when $\theta^* = \bar{\theta}$ than when $\theta^* = \underline{\theta}$. \square

Proof of Lemma 10, Part a. (θ, θ) and $(\theta, \underline{\theta}, \bar{\theta})$ represent cases under the GATT and the WTO, respectively, where both countries have announced a low shock. Under these situations both countries are supposed to set the respective agreement's low tariff in both sectors. At $\gamma = \hat{\gamma}$ the incentive compatibility constraint is binding under the WTO and $l^W = l^{Wr} > \tau^{PE}(\underline{\theta}) = l^G$. Therefore, the tariff recommended by the WTO in this situation is greater than the tariff recommended by the GATT, which implies that the payoff from cheating is lower under the WTO. Hence, $C^G(\theta, \theta) > C^W(\theta, \theta, \bar{\theta})$. \square

Proof of Lemma 10, Part b. I first calculate $C^W(\bar{\theta})$ and $C^G(\bar{\theta})$ and then show that $C^W(\bar{\theta}) < C^G(\bar{\theta})$. Under the WTO, when $\theta = \bar{\theta}$, the government's one-period welfare from cooperative tariffs is given by

$$\begin{aligned} u(s^W, \bar{\theta}) + \gamma v(l^W) + (1-\gamma)v(s^W) + (1-\rho)[u(l^W, \underline{\theta}) + v(l^W)] \\ + \rho[u(l^W, \underline{\theta}) + (1-\gamma)u(s^W, \underline{\theta}) + v(s^W)]. \end{aligned}$$

On the other hand, the welfare from non-cooperative tariffs is given by

$$u(\tau^N(\bar{\theta}), \bar{\theta}) + v(l^W) + u(\tau^N(\underline{\theta}), \underline{\theta}) + (1-\rho)v(l^W) + \rho v(s^W).$$

The difference between these two welfare levels gives the one-period payoff from cheating under the WTO. Namely,

$$\begin{aligned} C^W(\bar{\theta}) = u(\tau^N(\bar{\theta}), \bar{\theta}) + u(\tau^N(\underline{\theta}), \underline{\theta}) + (1-\gamma)[v(l^W) - v(s^W)] \\ - u(s^W, \bar{\theta}) - \rho(1-\gamma)u(s^W, \underline{\theta}) - (1-\rho + \rho\gamma)u(l^W, \underline{\theta}). \end{aligned}$$

Under the GATT, when $\theta = \bar{\theta}$, the government's one-period welfare from cooperative tariffs is given by

$$u(s^G, \bar{\theta}) + v(s^G) + (1-\rho)[u(l^G, \underline{\theta}) + v(l^G)] + \rho[u(s^G, \underline{\theta}) + v(s^G)].$$

On the other hand, the welfare from non-cooperative tariffs is given by

$$u(\tau^N(\bar{\theta}), \bar{\theta}) + v(l^G) + u(\tau^N(\underline{\theta}), \underline{\theta}) + (1-\rho)v(l^G) + \rho v(s^G).$$

The one-period payoff from cheating under the GATT is thus given by

$$\begin{aligned} C^G(\bar{\theta}) = u(\tau^N(\bar{\theta}), \bar{\theta}) + u(\tau^N(\underline{\theta}), \underline{\theta}) + v(l^G) - v(s^G) \\ - u(s^G, \bar{\theta}) - \rho u(s^G, \underline{\theta}) - (1-\rho)u(l^G, \underline{\theta}). \end{aligned}$$

This lemma states that $C^W(\bar{\theta}) - C^G(\bar{\theta}) < 0$ or, equivalently,

$$\begin{aligned} C^W(\bar{\theta}) - C^G(\bar{\theta}) = \rho[u(s^G, \underline{\theta}) - u(s^W, \underline{\theta})] + (1-\rho)[u(l^G, \underline{\theta}) - u(l^W, \underline{\theta})] \\ + \rho\gamma[u(s^W, \underline{\theta}) - u(l^W, \underline{\theta})] + \gamma[v(s^W) - v(l^W)] + [v(l^W) - v(l^G)] \\ + [u(s^G, \bar{\theta}) + v(s^G) - u(s^W, \bar{\theta}) - v(s^W)] < 0. \end{aligned}$$

Given that at $\gamma = \hat{\gamma}$ we have $u(s^W, \underline{\theta}) + \gamma v(s^W) = u(l^W, \underline{\theta}) + \gamma v(l^W)$, or equivalently, $u(s^W, \underline{\theta}) - u(l^W, \underline{\theta}) = -\gamma[v(s^W) - v(l^W)]$, we can rewrite this inequality as

$$\begin{aligned} C^W(\bar{\theta}) - C^G(\bar{\theta}) = \rho[u(s^G, \underline{\theta}) - u(s^W, \underline{\theta})] + (1-\rho)[u(l^G, \underline{\theta}) - u(l^W, \underline{\theta})] \\ + (1-\rho\gamma)\gamma[v(s^W) - v(l^W)] + [v(l^W) - v(l^G)] \\ + [u(s^G, \bar{\theta}) + v(s^G) - u(s^W, \bar{\theta}) - v(s^W)] < 0. \end{aligned}$$

To see why this inequality holds, first note that at $\gamma = \hat{\gamma}$ the incentive compatibility constraint under the WTO is binding and, thus, $s^W = s^{Wr}$ and $l^W = l^{Wr}$. Moreover, according to [Proposition 1](#) and [Lemmas 3 and 7](#), we have $s^G < s^{Wr} < \tau^N(\bar{\theta})$ and $\tau^{PE}(\underline{\theta}) = l^G < l^{Wr}$. Therefore, each of the first four brackets above has a negative value. Moreover, by investigating P^G and P^W it is evident that in order to have $P^G = P^W$ (which is the case when $\gamma = \hat{\gamma}$) we must have $u(s^G, \bar{\theta}) + v(s^G) < u(s^W, \bar{\theta}) + v(s^W)$, since otherwise $P^G > P^W$. Therefore $C^W(\bar{\theta}) < C^G(\bar{\theta})$. \square

The remainder of the appendix is related to the court's optimality problem introduced in [Section 9](#).

Lemma 12. *The optimal solution involves $(1-\alpha)\beta = 0$ and $\alpha \geq \beta$.*

Proof. The court's optimization problem can be written as

$$\begin{aligned} W(l, s, \alpha, \beta) \equiv \rho[u(s; \bar{\theta}) + u(s; \underline{\theta}) + 2v(s)] + 2(1-\rho)[u(l; \underline{\theta}) + v(l)] \\ + \rho[\gamma\alpha + (1-\gamma)\beta]\{[u(l; \underline{\theta}) + v(l)] - [u(s; \underline{\theta}) + v(s)]\}. \end{aligned}$$

$$\text{s.t. } u(s; \underline{\theta}) + [1 - \alpha(1 - \gamma) - \beta\gamma]v(s) \leq u(l; \underline{\theta}) + [1 - \alpha(1 - \gamma) - \beta\gamma]v(l).$$

To prove $\alpha \geq \beta$, by way of contradiction, assume that $\alpha < \beta$. In that case W can be increased by switching the values of α and β , while the incentive compatibility constraint will be still satisfied. To see this, note that since $\gamma > \frac{1}{2}$, the objective function improves if we switch the values of α and β . Moreover, since $\gamma > \frac{1}{2}$, the coefficient of $v(\cdot)$ in the constraint increases by switching the values of α and β . An increase in the coefficient of $v(\cdot)$ relaxes the constraint and, thus, the incentive compatibility constraint will continue to hold.

Given that $\alpha \geq \beta$, in order to prove $(1-\alpha)\beta = 0$, it is sufficient to show that an optimal solution cannot involve $0 < \alpha < 1$ and $0 < \beta < 1$ simultaneously. By way of contradiction, assume that $0 < \alpha < 1$ and $0 < \beta < 1$. This implies that $\frac{dL}{d\alpha} = \frac{dL}{d\beta} = 0$, where L is the Lagrangian of the above problem. It is straightforward to check that $\frac{dL}{d\alpha} = \frac{dL}{d\beta} = 0$ implies $\gamma = \frac{1}{2}$. Therefore, for $\gamma > \frac{1}{2}$ we have $(1-\alpha)\beta = 0$. \square

Lemma 13. *There exists $\bar{\gamma}_2 \in (\frac{1}{2}, 1)$ such that for $\gamma \geq \bar{\gamma}_2$ the optimal solution involves $0 < \beta < 1$ and $\alpha = 1$.*

Proof. Recall that when court is a pure public signalling device, that is when $\alpha = 1$ and $\beta = 0$, the incentive compatibility constraints are not binding when $\gamma > \gamma_2$ ([Lemma 5](#)). Therefore, since the expected joint welfare function is always increasing in α and β , the optimal solution must involve $\beta > 0$ for $\gamma > \gamma_2$. Finally, as long as $\gamma < 1$, no optimal solution can involve $\alpha = \beta = 1$ since otherwise the incentive compatibility constraint will be violated. Therefore, there exists $\bar{\gamma}_2 \in (\frac{1}{2}, 1)$, such that for $\gamma \geq \bar{\gamma}_2$ the optimal solution involves $0 < \beta < 1$ and $\alpha = 1$. \square

Lemma 14. *There exists $\bar{\gamma}_1 \in (\frac{1}{2}, 1)$ such that for $\gamma \leq \bar{\gamma}_1$ the optimal solution involves $\beta = 0$ and $0 < \alpha < 1$.*

Proof. According to [Proposition 2](#), for $\gamma < \hat{\gamma}$, the joint political welfare of the countries is higher under the GATT (i.e., when $\alpha = \beta = 0$) than under a WTO system that works as a public signalling device (i.e., when $\alpha = 1$ and $\beta = 0$). Therefore, $\alpha = 1$ and $\beta = 0$ cannot be optimal for sufficiently small γ . As a result, since $\alpha \geq \beta$ and $\beta(1 - \alpha) = 0$ ([Lemma 12](#)), for sufficiently small γ we have $\beta = 0$ and $\alpha < 1$. Finally, $\alpha = \beta = 0$ (i.e., the GATT reciprocity rule) cannot be optimal because under the GATT the incentive compatibility constraint is not binding while the welfare can be improved by increasing α ($\frac{dW}{d\alpha} > 0$ for $l = l^G$ and $s = s^G$). \square

Lemma 15. $\bar{\gamma}_1 < \bar{\gamma}_2$. Moreover, for $\gamma \in (\bar{\gamma}_1, \bar{\gamma}_2)$ the optimal solution involves $\alpha = 1$ and $\beta = 0$.

Proof. If $\bar{\gamma}_1 > \bar{\gamma}_2$, then [Lemmas 13 and 14](#) cause a contradictory result that $\beta = 0$ and $\beta > 0$ for $\gamma \in (\bar{\gamma}_2, \bar{\gamma}_1)$. \square

Proof of Proposition 5. This proposition follows from [Lemmas 12–15](#).

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